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ABSTRACT

Using five key indicators of nutritional status (dietary intake, biochemical tests for circulating levels of nutrients or their metabolites, anthropometric measures, low birth weight and infant mortality rates, and food, health, and income assistance program participation rates and benefit levels), this 1-year research project identified national, regional, and local data bases/resources providing reliable indications of the nutritional status of the rural poor and identified/interpreted patterns, issues, problems, and needs from these data sources. Data sources included the Second Health and Nutrition Examination Survey, natality and mortality tapes from the National Center for Health Statistics, state vital statistics offices, the Nationwide Food Consumption Survey, and the Bureau of the Census. Data analysis indicated consistent evidence of disparities between nutritional status of the rural poor and that of the nation as a whole; ongoing deterioration of the nutritional status of the rural poor as well as growing gaps between their status and that of the rest of the nation; and soaring numbers of poor rural persons unserved by government food, health, and income assistance programs or receiving disproportionate shares of programs (often less than 40% of the per capita level received by the urban poor). (NEC)

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the Nutritional Status of the Rural Poor

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A Report by
Public Voice for Food
and Health Policy

Ellen Haas, Executive Director
Jeffrey Shotland, Project Director
and Author

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Jeffrey Shotland, Project Director
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We wish to express our gratitude to the many individuals who contributed to this project. In particular, it was a privilege to work with the project's advisors, who gave generously of their time and wisdom: Dr. Luise Light, Dr. Catherine Woteki, Dr. Eileen Kennedy, and Molly Graber. We are also grateful to Professor Sam Shapiro, and Dr. Victor Sidel for their input toward the preliminary report on low birthweight and infant mortality. We also wish to express our appreciation to the entire staff at the National Center for Health Statistics for all the assistance they have provided throughout this study. In particular, we want to thank Clifford Johnson and Selma Taffel, for the expertise and technical guidance they shared with us.

Further, we wish to thank Dr. John Stanton and Debra Krakover of the Academy of Food Marketing at Saint Joseph's University for providing a wealth of information and analyses of NHANES II; Mr. Bob Bergland, Executive Vice President and General Manager of the National Rural Electric Cooperatives Association for his continued support and enthusiasm in the project; Vivian Gabor of the House Select Committee on Hunger for her numerous contributions to the study; Geoff Rosenthal for his generosity in providing biostatistics support to the project; Hillard Kaplan for his editorial contributions and his general input and guidance; Robert Hoppe of the USDA's Economic Research Service for his many contributions; Eleanor Witte Wright for providing research and analysis of assistance program participation and poverty data; Cliff Rouder and Sarah McKearnen for assisting with data collection and research.

We also wish to thank the entire staff at Public Voice for their numerous contributions throughout the project's duration, especially Pat Kelly, for her editorial and conceptual contributions, Judith Coombs for her research and graphic contribution, and Sherri Franklin for her tireless patience, vital wordprocessing and support contributions.

PREFACE

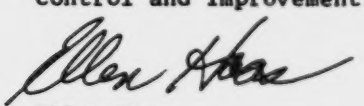
This is a report on the worsening nutritional health of a forgotten segment of our society--the rural poor. Greater in number than their urban counterparts (in 1983 there were over 13.5 million rural poor Americans compared to 12.87 poor living in central cities), the rural poor nevertheless are an underclass. They are underfed, undernourished and, in poor health. Further, their deprivation and neglect is, for the most part, unrecognized. The result is a health policy crisis of national proportions.

Public Voice for Food and Health Policy, a national consumer research, education and advocacy organization, spurred by concern and the lack of documentation of the nutritional needs of the rural poor, in 1984 proposed a research project to document their nutrition and health status. Our goal was to help build--and stimulate others to build--a reliable knowledge base on the nutritional status of the rural poor at a time when America's poverty rate was rising and reports of hunger and malnutrition were increasing around the country.

This document reveals the result of our year-long study. Supported by a grant from the Ford Foundation, we examined a variety of key nutrition indicators such as dietary intake and biochemical deficiencies as well as growth stunting, infant mortality and low birthweight rates. The data came from recognized national surveys and county and state vital statistics offices. In their totality, many of the findings are shocking; most are disheartening.

In the pages that follow you will read that rural poverty in America is distinct in its harshness; and that it is getting worse. At the same time, federal aid to rural Americans is shrinking. The result is a state of severely compromised nutritional status in rural America that grows worse daily. And there is no relief in sight--the rural poor, our research found, have few effective advocates for improved nutrition; no current means by which to halt their downward spiral.

This report will not feed the hungry. But it begins to lay out the complex web of effects on health and well-being that emerge from unabated malnutrition. It presents a clearer picture of the damage exacted upon rural America. It is, we hope, a small, first step toward assessing that damage with an eye toward its control and improvement.



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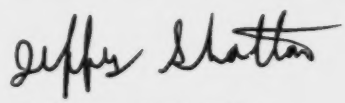
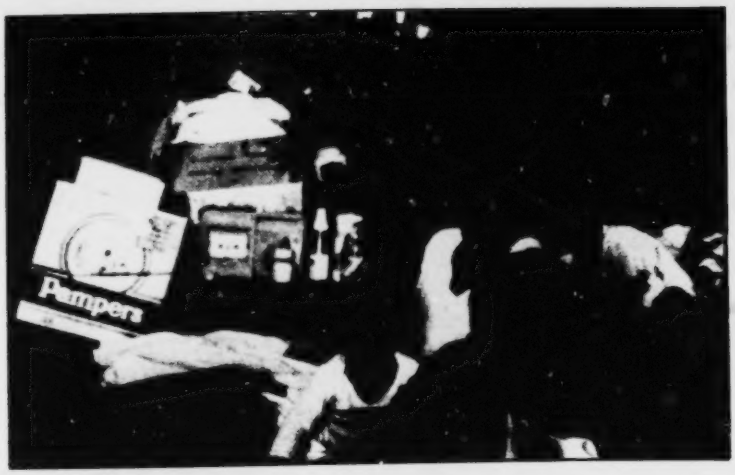
Executive Director

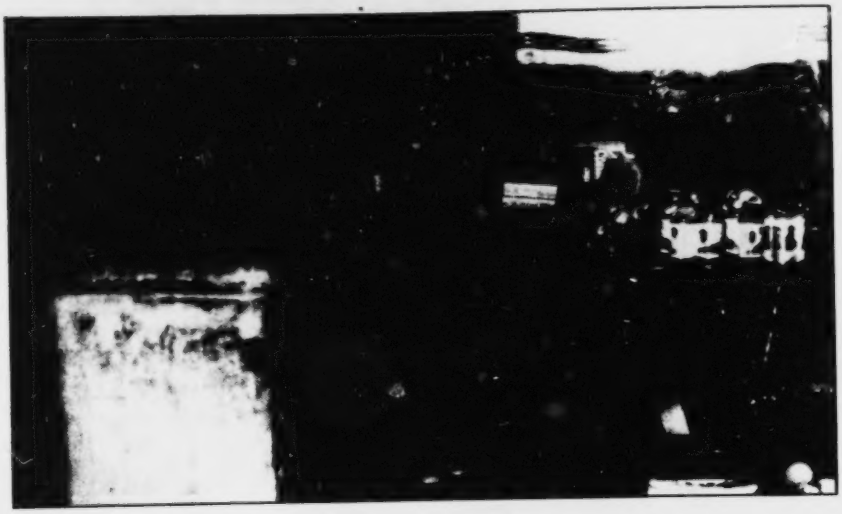


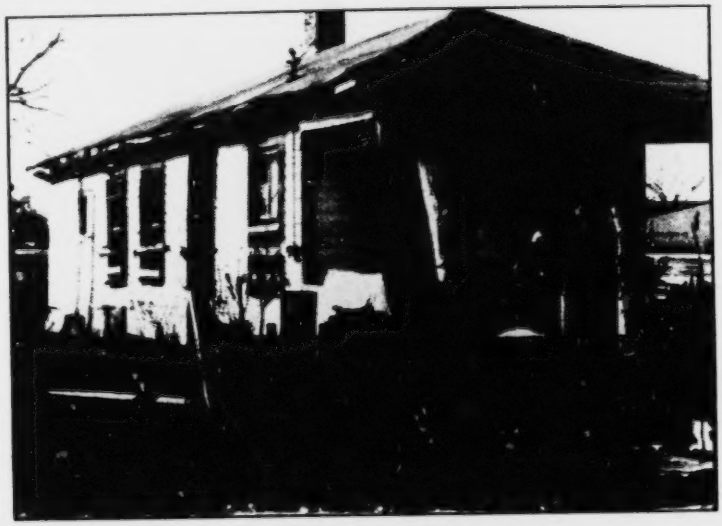
Jeffrey Shotland
Project Director and
Principal Investigator

ABOUT THE COVER

Photographs presented on the front cover and in the text were taken by the project staff during site visits to rural poor areas. These visits were conducted in Mississippi's Delta Region (Leflore and Humphreys Counties) and in Kentucky's Appalachia Region (Breathitt and Perry Counties).







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GLOSSARY

Metropolitan (metro) areas. Counties that are part of a Standard Metropolitan Statistical Area. (See Standard Metropolitan Statistical Area.)

Standard Metropolitan Statistical Area (SMSA). A county or group of counties containing at least one central city with a population of 50,000 or more, or a central city with a population of at least 25,000 if the city's population plus the population of contiguous, thickly populated places equals 50,000 or more. Additional contiguous counties are considered part of an SMSA if they are economically and socially integrated with the central city.

Central City. In general, a Central City is the largest city in a SMSA. In addition, other cities in the SMSA that have at least one-third as many residents as the largest city are usually considered central cities, provided they have greater than a predetermined number of residents.

Nonmetropolitan areas. Counties that are not part of a Standard Metropolitan Statistical Area. (See Standard Metropolitan Statistical Area.)

Nonwhite population. Blacks, Indians, Eskimos, Aleuts, Asians, Pacific Islanders, and members of other nonwhite races not elsewhere classified.

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SUMMARY OF FINDINGS

In the fall of 1984, with support from the Ford Foundation, Public Voice for Food and Health Policy initiated a year-long research project on the nutritional status of the rural poor. Our project was designed to systematically identify and appraise existing, significant information sources that could document this elusive status and form a reliable knowledge base about it. In doing so, we sought to answer two basic questions:

--What specific national, regional and local data bases or resources provide a reliable indication of the nutritional status of the rural poor?

--What patterns, issues, problems and needs can be identified from these data sources, or interpreted from our current state of knowledge?

Based on an extensive literature search and consultation with varied experts, Public Voice chose to study five key indicators of nutritional status. Data on these indicators as they related to the rural poor had never been gathered together and studied for a collective result. The indicators included:

1. Dietary Intake
2. Biochemical tests for circulating levels of nutrients or their metabolites
3. Anthropometric measures
4. Low birthweight and infant mortality rates
5. Food, health and income assistance program participation rates and benefit levels

For information on these indicators, Public Voice collected and analyzed data from the following sources:

1) The Second Health and Nutrition Examination Survey (NHANES II)
2) Natality and mortality tapes from the National Center for Health Statistics
3) State Vital Statistics Offices
4) The Nationwide Food Consumption Survey (USDA)
5) The Bureau of the Census

Our analysis of this data showed consistent evidence of startling disparities between the nutritional status of the rural poor and that of the nation as a whole. Further, much of the data indicate ongoing deterioration of the nutritional status of the rural poor as well as growing gaps between their status and that of the rest of the nation.

Following is a brief summary of the findings resulting from the analyses carried out for each indicator.

From the Second National Health and Nutrition Examination Survey (NHANES II), data on dietary intake, circulating biochemical nutrient levels, and anthropometric measures for the rural poor were analysed and compared to those of the entire U.S. nonpoor population* and the rural nonpoor population. The proportion of rural poor who fell below selected cutoff levels for each of these indicators was determined and compared to the proportion of the nonpoor for total races, and for whites and nonwhites. Inter and intra-regional analyses were also carried out.

* Nonpoor population consisted of all those living in households with incomes of at least two times the poverty threshold.

1. DIETARY INTAKE

Using dietary intake data from the Second National Health and Nutrition Examination Survey (NHANES II), diets of the rural poor were compared to those of the non poor for nine nutrients. Comparison was based upon the percent of individuals who consumed less than two-thirds of his or her age-sex specific recommended intake level for each nutrient.

For every nutrient examined, the rural poor were less likely to consume adequate levels than were the non poor. And, with the exception of thiamin, these differences were all statistically significant. The nutrients for which the rural poor were least likely to consume adequate levels were calcium, iron, vitamin A and vitamin C. Adequate consumption of niacin and vitamin B6 (Pyridoxine) also appeared to be problematic among this population. Other findings included the following:

- The increased prevalence of inadequate intake experienced by the rural poor over the nonpoor varied from a difference of 7 percent (for thiamin) to nearly 100% (for protein).
- Rural poor persons residing in the Northeast exhibited the lowest prevalence of inadequate consumption for the nutrients studied, whereas the diets of the rural poor living in the South and West were the least likely to be adequate.
- Diets of nonwhite rural poor residents were less likely to be adequate than were diets of white rural poor residents.
- Calcium intake was a significantly larger problem for rural poor nonwhites than for rural poor whites.
- USDA data demonstrated that the rural poor had lower mean intakes for 11 of 13 nutrients studied than did either suburban or central city poor.
- USDA data also demonstrated that rural poor children consumed considerably less vitamin A and vitamin C than did poor children who live in the central city.

2. BIOCHEMICAL INDICATORS

Biochemical data from NHANES II were analyzed for four nutrients: iron, vitamin A, vitamin C, and zinc. For each nutrient, age-sex specific biochemical cutoff values were selected below which individuals were considered to have low levels and therefore to be at increased risk of deficiency. These analyses revealed that low levels of these four nutrients among the rural poor were serious and widespread. The rural poor were found to experience abnormally low levels between 51.6 and 152.0 percent more frequently than the nonpoor. Moreover, a strong and consistent relationship was observed between biochemical results and dietary intake results.

Among the nutrients studied, low levels of vitamin A among children of the rural poor appeared to be the greatest problem, with nearly one out of two exhibiting low levels of this nutrient. Furthermore, children of the rural poor were almost 60 percent more likely to have circulating levels below the cutoff for this nutrient than were nonpoor children. Of the remaining three nutrients studied, low levels of serum zinc occurred most frequently among the rural poor (13.8 percent of the population). Moreover, low levels of this nutrient

occurred 51.6 percent more frequently among the rural poor than among the nonpoor. Serum vitamin C levels among the rural poor were deficient over 150 percent more frequently than among the nonpoor, while the rural poor had abnormally low hemoglobin levels (iron deficiency) 80 percent more often than did the nonpoor.

Other findings resulting from these analyses included the following:

o The Northeastern rural poor were found to have the lowest prevalence of nutrient levels below cutoff values compared to rural poor residents living in other regions.

o The rural poor residing in the South had the highest prevalence of abnormally low nutrient levels.

o The Western rural poor exhibited low nutrient levels at a slightly l o w e r prevalence than did those of the South, while those of the Midwest were intermediate between the West and the Northeast.

o Rural poor nonwhites experienced abnormally depressed levels of iron and zinc at a significantly higher rate than did rural poor whites, whereas low levels of vitamin C were more prevalent among rural poor whites than rural poor nonwhites.

o Although low circulating levels of vitamin A appeared to be prevalent among both racial groups, results indicated that status of this nutrient was income-related among rural whites, while among rural nonwhites it was found to be independent of income group.

3. **ANTHROPOMETRY**

Two distinct anthropometric indexes were calculated: height-for-age and weight-for-height. While the former is a widely accepted indicator of long-term or chronic under-nutrition (growth stunting), the latter is more indicative of either acute forms of under-nutrition (wasting) or severe overweight (obesity).

Height-For-Age

Analysis of data from NHANES II demonstrated that rural poor children experienced short stature nearly two and one-half times as often as nonpoor children. In addition, short stature was experienced significantly more often by nonwhite poor rural children than by white rural poor children.

Geographically, the prevalence of growth stunting was highest in the South, where the rate among rural poor children (8.8% or 3.8% above the expected rate) was nearly three times the rate among nonpoor children (3.1%).

Weight-For-Height (below the fifth percentile - wasting)

Rural poor children overall were not found to experience wasting at a greater rate than were nonpoor children. However, a small excess over the expected prevalence was observed among white rural poor children who resided in the South, of whom 6.1% had weight-for-height indexes below the fifth percentile.

Weight-For-Height (above the 95th percentile-obesity)

Rural poor children were somewhat more likely to be obese than were nonpoor children (6.8% vs. 5.1%). This problem was experienced most fequently in the Northeast, whereas the rural poor residing in the South had the lowest prevalence. The South was the only region in which the rate of obesity was

higher among nonpoor children than rural poor children (5.9% vs. 4.4%).

While rural poor nonwhite children experienced a higher rate of obesity than did rural poor white children, among nonwhites there was a positive relationship between income and obesity (i.e. the nonpoor had a higher rate of obesity) whereas among white children, an inverse relationship was observed (i.e., the nonpoor had a lower prevalence than the rural poor).

4. LOW BIRTHWEIGHT AND INFANT MORTALITY

Low birthweight (LBW) and infant mortality rates (IMR) were collected and analyzed from rural counties in which at least one-third of residents were living in poverty in 1979 (the most recent year for which county specific poverty rates are available). Rates for these 85 counties were aggregated for each year from 1980 to 1983 for LBW, and from 1981 to 1983 for IMR. These rates were then compared to the rates for the rest of the nation. These analyses resulted in the following findings:

Low Birthweight

- Low birthweight rates were significantly higher in poor rural counties than in the rest of the nation.
- The gap which already existed in 1980 between LBW rates in rural poor counties and rates in the rest of the nation, had increased by 34 percent by 1983.
- Low birthweight rates in rural poor counties have undergone steady increases since 1980.

Infant Mortality

- The infant mortality rate was significantly higher in rural poor counties than in the rest of the nation.
- While the national IMR dropped steadily between 1981 and 1983, it increased in rural poor counties during that period.
- The disparity between the IMR in rural poor counties and the rest of the nation increased from 32.9% in 1981, to 46.4% by 1983.
- Most of the increases in the IMR in rural poor counties were the result of increased rates among nonwhites.

5. ASSISTANCE PROGRAM PARTICIPATION AND BENEFIT LEVELS

Analysis of program data from several key food, health and income assistance programs revealed large disparities between the rural poor and the urban poor. In addition to being significantly less likely to participate in most assistance programs, the rural poor who did participate received lower benefit levels overall than the urban poor. Moreover, the number of poor rural residents unserved by these programs has risen dramatically since 1979. Other findings from this analysis included:

- The number of rural poor who do not receive Food Stamp benefits has increased sharply in recent years--by 1983, the number of rural poor who were unserved exceeded 7,510,000.
- Only 31% of the elderly rural poor received Food Stamps.
- Per capita, the rural poor received significantly less in Food Stamp benefits than did the metropolitan poor.
- The number of poor rural female-headed households unserved by the Food Stamp program increased by almost 50% between 1979 and 1983.

o Distribution of AFDC benefits was also inequitable--the metropolitan poor received more than three times the amount (per capita) as the rural poor.

o The Social Security Income Program, General Assistance Programs, and the Free and Reduced Price School Lunch Program also provided disproportionately greater benefits to the metropolitan poor than to the rural poor.

CONCLUSION

The rural poor are a large, socially and geographically diverse population, profoundly hampered by poor nutrition and by the debilitating health consequences which result. This study demonstrates that their diets are significantly less adequate than those of our nation's nonpoor, and that for most nutrients, their diets are considerably worse than those of the urban poor.

Our inquiry found that the rural poor are also far more likely to experience depressed biochemical nutrient levels and growth stunting among their children, than are Americans with higher incomes. In addition, low birthweight and infant mortality rates are significantly higher in rural poor counties than in the rest of the nation. Analysis of program data also revealed that the number of poor rural persons unserved by government food, health and income assistance programs has soared since 1979, and that the rural poor receive a grossly disproportionate share of these programs--often less than 40% the per capita level received by the urban poor.

Furthermore, we found that there is a significant void of current, reliable nutrition status data available on this population group. A fact which is especially disturbing at a time when the number of persons in poverty has undergone large increases, and reports of increasing hunger and a general "backsliding" of the nutritional status of Americans have been cited by a steadily growing number of our nation's leading health and nutrition experts.

In light of our findings, the need for greatly increased nutrition monitoring and targeted policy changes which address the specific nutritional conditions and problems of the rural poor is clear and urgent.

Chapter 1

INTRODUCTION

Chapter 1

INTRODUCTION

In recent years, most attention about hunger and issues of undernutrition has focused on conditions among the urban poor in cities throughout our country. Reports addressing the nutritional status of the poor have increased as our nation's poverty rate has risen dramatically. However, these reports come principally from the cities where mayors, religious leaders, and health officials cite growing lines at soup kitchens, church pantries, and emergency food centers.

A number of recent studies document these reports and suggest that hunger and malnutrition are once again serious public health problems. However, these too are heavily weighted towards urban populations. But what of the rural poor? How has poverty affected their nutritional and health status?

The needs of rural citizens, particularly those in poverty, are routinely overshadowed in national policy deliberations--eclipsed by the needs of urban populations, whose far greater visibility earn them disproportionate representation. While there were 12.9 million poor living in our nation's cities in 1983, America's rural poor numbered 13.5 million (1) -- a nation unto themselves. Given the rigors of poverty, and particularly of rural poverty, the nutritional status of this group is a matter for serious concern.

The disproportionate media coverage received by the urban poor coupled with the significantly greater research emphasis surrounding them has led to the unfounded assumption that the urban poor are the "worst-off" nutritionally of our nation's poor. In contrast, we have found that there is a paucity of research documenting the nutritional status of the rural poor. While a wealth of empirical data on their nutritional status has been collected, they have never been de-aggregated and studied for what they can tell us about the rural poor.

Public Voice therefore undertook a systematic investigation of the nutritional status of the rural poor. Our broad goals were to help build a knowledge base in this area that would assist in the re-orientation of food and assistance policies and priorities more fine-tuned to the actual conditions and problems experienced by the rural poor. We also hoped that this study would serve to spark the interest of those in related fields, enabling those who work on food and agriculture, anti-poverty, consumer, rural development and public health issues to put this issue squarely on the national agenda and to formulate policies that respond to the actual needs of this neglected group of Americans.

PROBLEM STATEMENT

Rural Poverty in America Has Worsened

The study comes during a period when our nation overall has experienced some of the most extreme economic pressures since the pre-World War II era. In particular, America's farm economy, which has a wide-reaching impact on the general rural

economy, is experiencing its worst crisis since the Great Depression.

Rural America, with 32.2 percent of the nation's total population, in 1983 had 38.3 percent of the nation's poor--13.516 million persons(1). Moreover, this figure represents a 36 percent increase over the 9.9 million rural persons who were poor in 1979 and an increase in the rural poverty rate from 13.8 percent to 18.3 percent of the total rural population (1). Rural America, then, has seen a sharp rise in both absolute numbers of poor persons and in the rate of poverty.

As more rural persons have fallen into poverty, the plight of families in poverty in rural America has worsened. Since 1970, high inflation has eroded the purchasing power of welfare payments not indexed to inflation by over 36 percent. And federal taxes taken from the incomes of families at the poverty line have risen from 1.9 percent in 1979, to 10.2 percent in 1984. In 1985 the poor will be taxed at a rate of 10.5%.*

Federal Aid To The Poor Is Shrinking

While the poverty population has grown and its poverty has deepened, the Federal Government's response has been to pull back on the very programs which have proven effective at counteracting the detrimental impact of poverty, particularly those which attempt to provide adequate food and health care for the poor and underprivileged.

Curtailed eligibility standards and reduced benefits in major assistance programs have been the result. The Congressional Budget Office reports that the combined effects of 1981 and 1982 budget and tax cuts were to cut $20 billion in benefits from households with incomes below $10,000 a year. And Census data indicate that over 40 percent of all households below poverty--almost five million households, received no Medicaid, Food Stamps, or Free or Reduced Price School Lunch at all in 1982. This number grew even larger in 1983 (2,3).

For the rural poor, these problems are compounded: rural populations have been traditionally underserved by assistance programs because of categorical eligibility requirements that discriminate against intact rural families, because of inadequacies of program delivery systems, and because they have greater difficulties transporting themselves to program offices. Put most simply, more and more Americans have fewer and fewer dollars with which to buy food, and in rural areas, in particular, where need is greater, less aid is available or accessible.

The Nutritional Status of the Poor is Worsening

Not surprisingly, as poverty has grown wider and deeper without a corresponding expansion of food aid, from around the country have come reports of growing hunger and malnutrition. These include the U.S. Conference of Mayors' report, "Hunger in American Cities" (4), the

* Includes only Federal and Employment Tax. Expressed as a percent of total income which is taxed for a family of 4, living at the poverty threshold. Taken from Congressional Joint Committee on Taxation.

Center for Budget and Policy Priorities' report on emergency food services (5), findings of the New York State Hunger Watch (6), the Citizens' Commission on Hunger in New England (7), the Food Research and Action Center's study on Hunger in the 80's (8), the 1985 Arkansas Hunger Project's Report, Hunger in Arkansas (69), a study by Cook County Hospital (10), a special study conducted by the Massachusetts Department of Public Health at the direction of the state legislature (11), and most recently the Physician's Task Force on Hunger's 1986 report on Hungry Counties (12).

Many of our nation's leading health and nutrition scientists insist that once again America is backsliding with regard to nutritional status (13,14,15). Commenting on this current trend at a recent hearing held jointly by the House Select Committee on Hunger, and the House Subcommittee on Health and the Environment, renowned nutritionist and President of Tufts University, Jean Mayer, stated: "Researchers throughout the nation have reported recent increases in the prevalence of several types of malnutrition" (14). Echoing Dr. Mayer's comments come reports from Massachusetts (11), New York State (6), Maryland (17), West Virginia (18), California (16) and other areas, each reporting increasing levels of unmet need and worsening nutritional conditions.

During the same hearing, Dr. William Dietz, Director of Clinical Nutrition, Department of Pediatrics at the New England Medical Center, added that "what we are seeing is only the tip of the iceberg" (15). He indicated the probability that the increasing numbers of malnourished children being seen represent a larger underlying distribution of our nation's youth who are experiencing mild or moderate levels of malnutrition which is yet to be diagnosed.

Poverty and Malnutrition

These studies, as well as others carried out by the Center for Disease Control (CDC) (9) and by the National Center for Health Statistics (19), have consistently found that poverty is directly linked to malnutrition as well as to a host of other health risks.

In addition, results of the United States Department of Agriculture's (USDA) 1977-1978 Low Income Household Food Consumption Survey again confirmed this closely linked relationship between poverty and increased risk of an inadequate diet (20).

That hunger and malnutrition are once again serious national issues is evidenced by the fact that in 1983, a Presidential Task Force on Food Assistance was appointed to inquire into the problem. Its findings, inconclusive at best, were sharply challenged by state and local officials and public health professionals as ignoring a real and worsening problem.

Not surprisingly, the Task Force report, like the others cited above, was oriented towards urban problems, which are more visible and readily appraised than rural problems. But if hunger and malnutrition are growing problems among the urban poor, what is the plight of the rural poor?

This question is troubling, for in rural

areas, malnutrition may pose an even greater threat to health. Poverty in rural America is harsh, characterized by poor plumbing, inadequate sanitation, and substandard housing--all a continuing threat to health (21). In particular, the presence of coliform bacteria in much of the rural water supply poses an ubiquitous threat of infectious disease. Under these stresses, adequate nutrition takes on an increased role in preventing disease.

Aggravating this threat are the inadequacies of health care services and delivery systems for other assistance programs, which have traditionally left rural populations underserved. Faced with a greater threat to health, and with fewer resources for maintaining or restoring health, the rural poor are particularly vulnerable.

The Costs of Malnutrition

The malnutrition and related syndromes observed among the the poor are of serious concern not only because of the immediate human suffering they signify, but also because they undermine health, and thereby exact an enormous direct and indirect toll on the individual, the family, and society.

Poor nutrition impairs learning, cognitive development, and the ability to concentrate and work productively; also the capacity for prolonged physical work and both worker motivation and productivity.

It reduces resistance to disease and increases the severity of disease, and is associated with increased fetal, infant, child, and certain types of maternal mortality.

In 1977, the General Accounting Office estimated that roughly one third of our nation's annual health bill could be saved if Americans improved their nutritional status. The links between poverty, malnutrition, and poor health suggest that the poor nutritional status of the growing numbers of Americans who live in poverty boosts our nation's health bill, and is a public health problem of significant dimensions.

The Rural Poor Need Additional Advocacy for Improved Nutrition

Public Voice's work in the area of food and agriculture policy--with consumer, anti-poverty, anti-hunger, health, farm, women's, commodity, environmental, and other groups, and with national policy leaders--has made us keenly aware that the needs of the rural poor differ in some significant respects from those of the rest of the population, including their urban counterparts.

The rural poor are among the most invisible of Americans. Although proportionately poverty is greater in rural than in metropolitan areas, the rural poor are geographically remote and dispersed, and politically weak. Commanding little media attention, they have been too often neglected in national policy-making deliberations, and are too often "served" by policies fashioned primarily for urban populations.

While there is a rural agenda, it has by and large not included the nutritional and health problems of the rural poor; and while increasing attention is being paid to rural economic development, there is not yet a clear recognition of how important nutritional well-being and health are to the economic vitality of a population.

There is a growing community of interest around rural hunger and malnutrition, but no voice directly addresses the issue of the nutritional status of the rural poor.

This interest was recently evidenced during the release of Harvard University's Physician's Task Force Report on Hunger Counties (12). That report succeeded in bringing a great deal of attention to the rural nutrition crisis.

It also served to sensitize the American public (and media) to some of the nutrition-related problems faced by our nation's rural poor, but more, it exposed the public to the lack of consensus and data which exists with regard to rural nutrition issues.

Approach to the Study

The principal strength of this study and its findings emerges from the collection and analysis of several distinct lines of empirical evidence on nutritional status. The study includes data on dietary intake, biochemical and hematological tests for circulating nutrients, anthropometric indicators--including height-for-age, and weight-for-height--and the prevalence of low birthweight and infant mortality. Also included is an analysis of the utilization of public assistance programs by the rural poor, including program participation and benefit levels for several of the major assistance programs.

While each of these types of nutrition indicators provides valuable information, when viewed in isolation, each presents significant limitations. For example, knowledge of dietary inadequacy is helpful for nutrition and public health planners, but its significance is difficult to interpret without the benefit of some form of "outcome" data, such as circulating nutrient levels, or inadequate growth.

Therefore, the strength of this study results from having amassed and analyzed data from several of the pricipal indicators of nutritional status. Furthermore, the unusually consistent findings generated from each of the distinct types of nutrition status data add to the level of confidence which can be given to the study's results.

Chapter 2

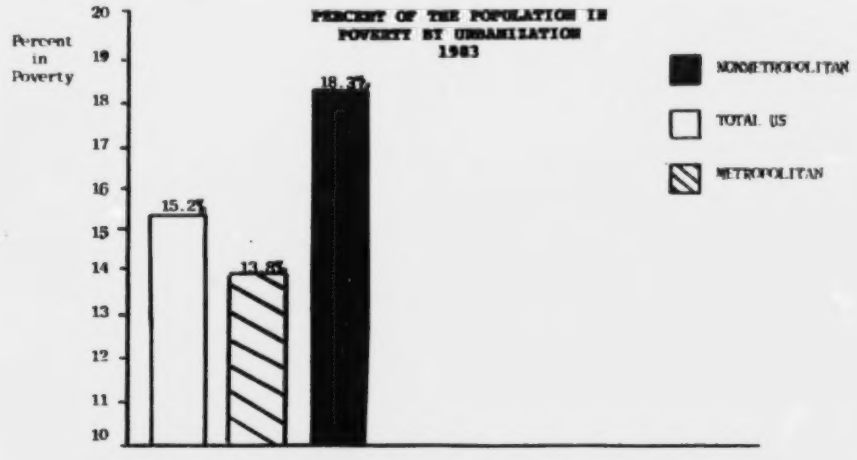
THE RURAL POOR — A DEMOGRAPHIC PROFILE

Who and where are the rural poor? Any analysis of their nutritional status first requires a general understanding of their social characteristics, working and living environments, and geographic distribution.

We must also dispel some important misconceptions about this large virtually invisible population. Perhaps the most common one is that the rural poor are predominately farmers and farm families. The fact is that, as the proportion of rural residents living on farms has undergone dramatic decreases over the past several decades, so has the number of poor rural farm families (22). According to the most recent survey conducted by the Census Bureau, only 6-8% of poor nonmetropolitan residents lived on farms in 1983 (1,23). In 1982, only 1.2 million poor people throughout the U.S. lived on farms (22).

Another common misconception is that the "central city" poor outnumber the rural poor. However, according to the Census Bureau, there are more rural Americans living in poverty than there are poor city dwellers (1). In 1983 the rural poor numbered over 13.5 million, while the poor living in central cities numbered slightly under 12.9 million.* Additionally, in 1983 the poverty rate among nonmetropolitan residents was more than 20% higher than the national rate, and almost 40% higher than the metropolitan rate for the same year (2). (Fig.2-1 Table 2-1)

FIG. 2-1



Source: Current Population Reports, Series P-60, Money Income and Poverty Status of Families and Persons in the United States, respective years.

* Although the nation's 1984 poverty rate was recently released, no metropolitan/nonmetropolitan breakdown was available at the time of this study.

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TABLE 2-1

PERSONS BY POVERTY STATUS, METRO-NONMETRO 1979-1983
(in thousands)

YEAR	TOTAL			METRO			NONMETRO		
	Total Population	Total Poverty	Percent Poverty	Total Population	Total Poverty	Percent Poverty	Total Population	Total Poverty	Percent Poverty
1979	222,838	26,072	11.7	150,785	16,134	10.7	72,007	9,937	13.8
1980	225,027	29,640	13.2	151,993	18,157	11.9	73,034	11,483	15.7
1981 *	227,157	31,822	14.0	153,612	19,347	12.6	73,545	12,475	17.0
1982	229,412	34,398	15.0	155,634	21,247	13.7	73,778	13,152	17.8
1983	231,612	35,266	15.2	157,615	21,750	13.8	73,997	13,516	18.3

Source: Current Population Reports, Series P-60, Money Income and Poverty Status of Families and Persons in the United States, respective years.
* Beginning in 1981, differentials in the poverty threshold for sex of householder and farm-nonfarm residence were eliminated.

Between 1969 and 1978, poverty rates decreased steadily in nonmetropolitan areas. During that period the number of nonmetropolitan poor dropped from 11.5 million to 9.4 million. However, a reversal which began in 1979 has since continued, and by 1983 the number had increased to over 13.5 million, or 18.3% of the total nonmetropolitan population (Fig 2-2).

Also of importance is the recognition that the rural poor are an extremely heterogeneous population. Included are individuals of Caucasion, Black, Hispanic, Native American, Asian, and numerous other ethnic backgrounds. They are found in every state throughout our nation, living in mountainous areas, the deserts of the Southwest, adjacent to southern plantations, on river banks or coastal areas, and in small towns throughout the country.

Despite their socio-demographic diversity, the rural poor also share a number of common characteristics, many of which are quite different from those of other poor segments of the U.S. population. In the following pages, these characteristics are briefly summarized.

Defining Terms

There is a need to define as clearly as possible some of the basic terms used throughout this report. For the purpose of consistency and ease, the term "poverty", as it is used here, refers to its official definition by the Office of Management and Budget. The following definition was excerpted from Series P-60 of Current Population Reports from the Census Bureau (1).

"Poverty" definition. Families and unrelated individuals are classified as being above or below the poverty level using the poverty index originated at the Social Security Administration in 1964 and revised by Federal Interagency Committees in 1969 and 1980. The poverty index is based solely on money income and does not reflect the fact than many low-income persons receive noncash benefits such as food stamps, Medicaid, and public housing.

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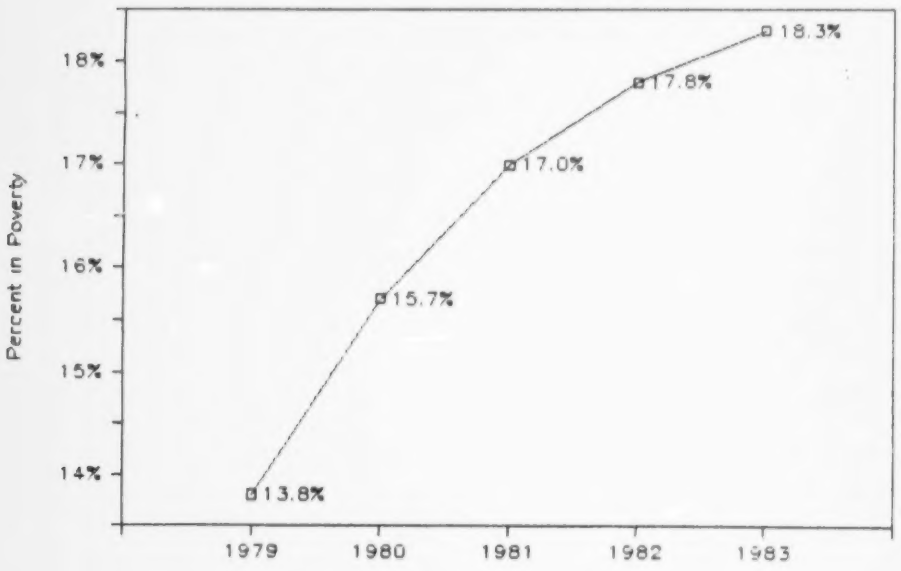
Fig. 2-2

GROWTH OF POVERTY IN RURAL AMERICA
(Expressed as percentage of rural population)
1979-1983[1]



Source: Current Population Reports, Series P-60, Money Income and Poverty Status of Families and Persons in the United States, respective years.

[1]Nonmetropolitan poverty rates used

The index is based on the Department of Agriculture's 1961 Economy Food Plan and reflects the different consumption requirements of families based on their size and composition. It was determined from the Department of Agriculture's 1955 Survey of Food Consumption that families of three or more persons spend approximately one-third of their income on food; the poverty level for these families was, therefore, set at three times the cost of the Economy Food Plan. For smaller families and persons living alone, the cost of the Economy Food Plan was multiplied by factors that were slightly higher in order to compensate for the relatively larger fixed expenses of these smaller households. The poverty thresholds are updated every year to reflect changes in the Consumer Price Index (CPI)".

This method of defining poverty has several shortcomings (24). It is outdated, in that the ratio of income spent on food is likely to have changed a great deal since 1955. Also, before-tax income is used rather than after-tax (or available) income. In addition, no consideration is given to non-cash program benefits, which have increased considerably since 1955. Most critics believe that this definition leads to underestimations of the prevalence of poverty. This is particularly true for rural Americans (who receive a significantly lower level of non-cash benefits from the

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government than do the nation's poor in general). Nevertheless, for purposes of consistency it is used throughout this study. An across-the-board definition for "rural" is even more problematic. In fact, if we were to restrict our use of the term "rural" to one established definition, we would be unable to use the health and nutrition data available on much of the population of interest; different definitions are used by the various federal and state agencies which collect health and income data.

For the purpose of this study, then, we follow the definition used by the Bureau of the Census for nonmetropolitan.* These terms--rural and nonmetropolitan--will be used interchangeably throughout this report.

SOCIO-DEMOGRAPHIC CHARACTERISTICS

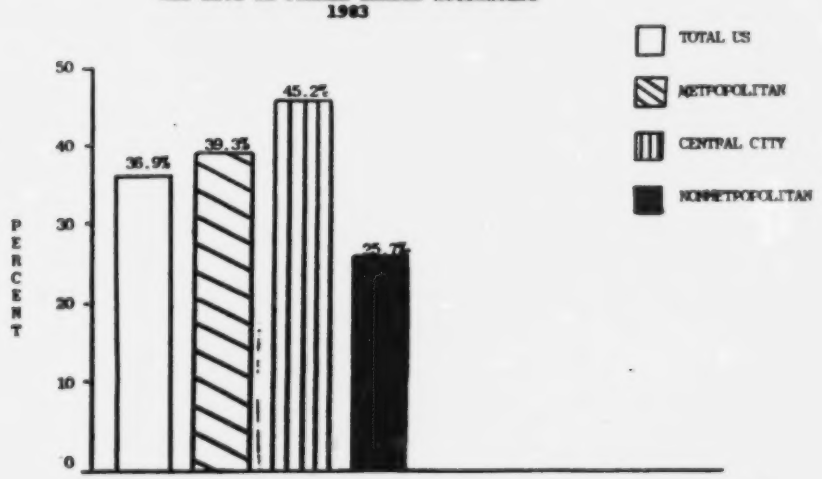
Female-Headed Households

A significantly lower proportion of the rural poor live in female-headed households, with no husband present, than do their urban counterparts. The percentage of such households is nearly two times greater among central city poor than among the rural poor. (Figure 2-3)

Since many states require that households be female-headed, (i.e., no husband present) in order to be eligible for both the Medicaid and Aid to Families with Dependent Children (AFDC) programs, this differential results in the categorical exclusion of a disproportionately large number of the rural poor from both of these programs. Expenditure data collected from these programs have verified the extent of this discrimination against the rural poor (25). (These data are presented in Chapter 8, Fig. 8-3)

FIG. 2-3

PERCENT OF THE POVERTY POPULATION WHO LIVE IN FEMALE-HEADED HOUSEHOLDS 1983



Source: Current Population Survey, P-60, Dept. of Commerce, 1984

* This definition itself changed in 1979, 1981, and again in 1983. In general our data reflect the definition used at the time data was collected.

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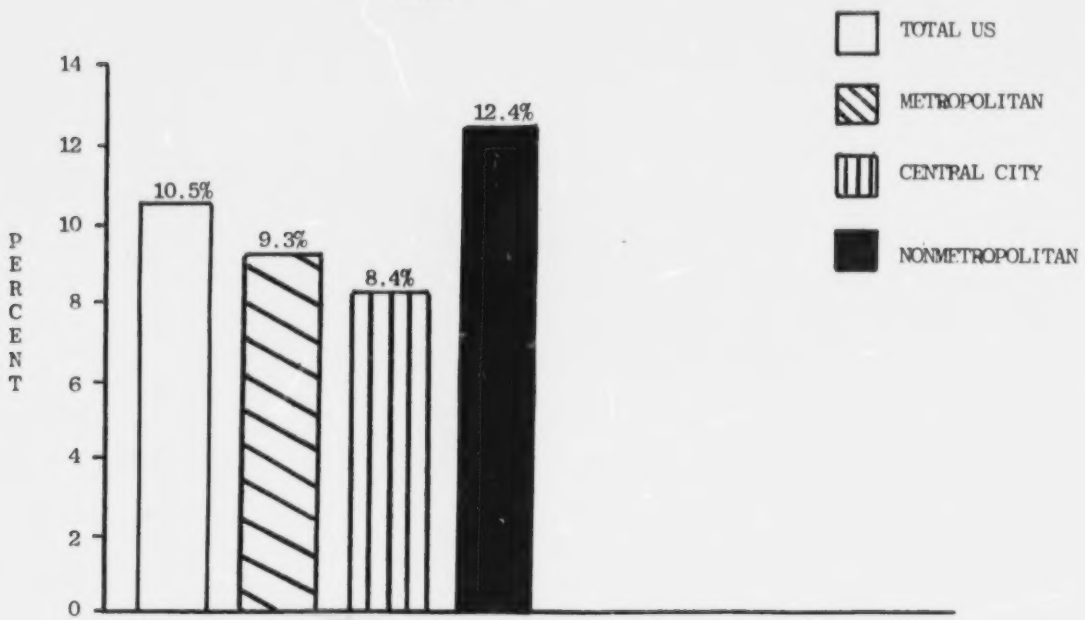
FIG. 2-4

PERCENT OF POVERTY POPULATION 65 YEARS AND OLDER 1983



Source: Current Population Reports, Series P-60, Money Income and Poverty Status of Families and Persons in the United States, respective years.

Elderly

In addition to their greater tendency to live in two-parent households, the rural poor are also far more likely to be elderly (65 + years) and living alone than their metropolitan or central city counterparts (See Fig. 2-4) (1,26). In 1983, the elderly accounted for 12.4% of the total nonmetropolitan poor population. This was almost 50% higher than among the central city poor, and over 33% higher than among the metropolitan poor. Furthermore, the rate of poverty among the elderly was significantly higher in nonmetropolitan areas (17.8%) than in either metropolitan areas or central cities (12.1% and 14.3%) (Fig 2-5). Since the low-income elderly population is known to experience greater health and nutrition risks, and since many elderly rural poor live alone--often far from health facilities or other resources, health conditions among this population should be given particular attention (26).

Racial Composition

The racial composition of the rural

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TABLE 2-2

Racial Composition of Poverty Population
(Expressed as a percentage)

	White[1]	Black	Other
Total U.S.	67.9%	28.0%	4.1%
Metropolitan	63.5%	32.1%	4.4%
Central City	52.3%	42.4%	5.3%
Non-metropolitan	75.1%	21.3%	4.6%

Source: Current Population Survey, March 1984, Bureau of the Census, Department of Commerce.
[1]Persons of Hispanic and Hispanic-American Origin are included in White category.

poor also differs from that of the urban poor (Table 2-2). Whereas blacks comprise 42.4% of the central city poor, and 32.1% of the metropolitan poor, they account for only 21.3% of the nonmetropolitan poor. Similarly, whereas whites make up 75.1% of the nonmetropolitan poverty population, they account for only 52.3% of the central city poor, and 63.5% of the metropolitan poor population (26). Furthermore, almost 85% of poor nonmetropolitan blacks reside in the southern portion of the U.S.

Educational Attainment

More than two out of every five rural poor persons over the age of 25 have not completed high school. This rate is considerably higher than that among poor metropolitan or central city residents who tend to achieve higher levels of education than the rural poor (26). (See Figure 2-6).

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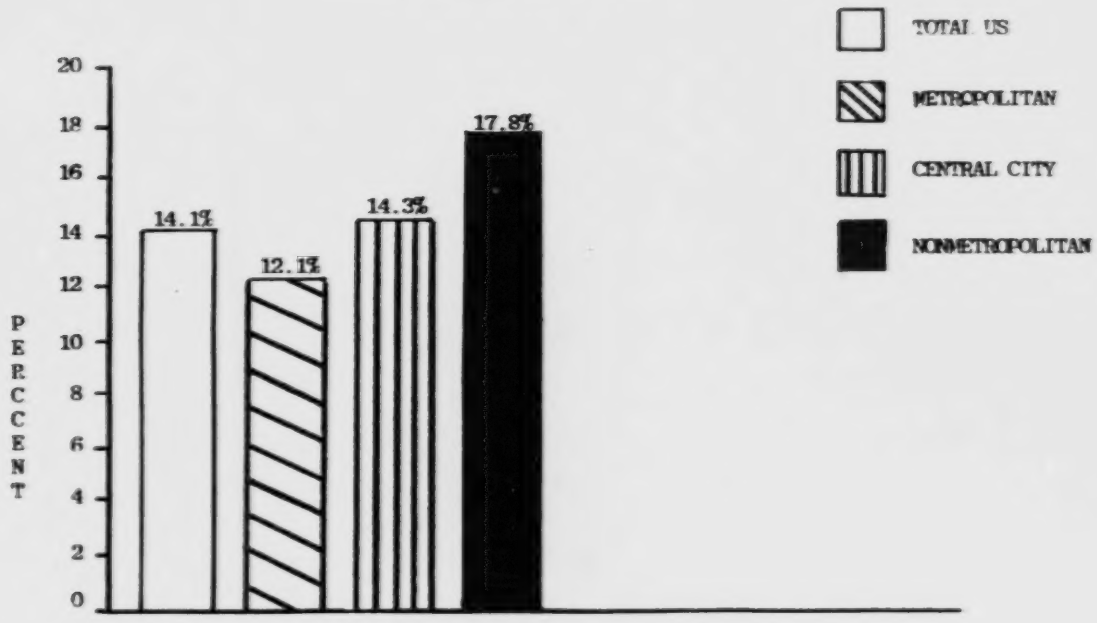
FIG. 2-5

PERCENT OF THE ELDERLY POPULATION
(65 YEARS AND ABOVE)
LIVING IN POVERTY IN 1983
BY URBANIZATION



Source: Current Population Reports, Series P-60, Money Income and Poverty Status of Families and Persons in the United States, March 1984.

This graph also shows that the rural poor are significantly less likely to complete four years of college than are the metropolitan or central city poor. Perhaps even more meaningful, a study conducted by Kate Jesberg, using 1975 Census Bureau data, showed that over one-third (36.21%) of all nonmetropolitan family heads over 25 years of age had not even completed elementary school (27).

Involvement In The Labor Force

Despite their lower educational attainment, nonmetropolitan household heads have consistently been more involved in the labor force than the urbanized poor (27). Jesberg found that 57.5% of nonmetropolitan family heads were involved in the labor force, whereas only 45.4% of metropolitan family heads worked (27). More recent data (1982) show that 68% of rural poor families had at least one employed worker and 28% had two or more (21). Comparable metropolitan figures were 54 and 17 percent for that year (22). Jesberg also found that of those rural poor who did work, over half worked less than full time (56.5%). And, among those who worked part-time, the primary reason reported for not working full-time was an inability to find work (27). It is also worth noting

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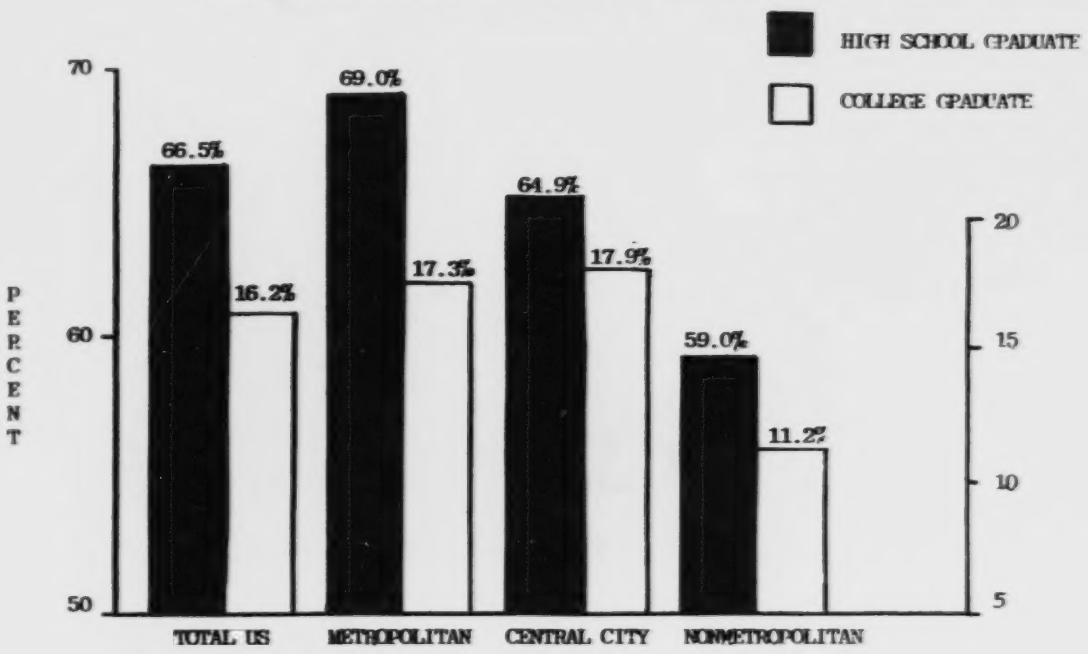
FIG. 2-6

EDUCATIONAL ATTAINMENT

PERCENTAGE OF POVERTY POPULATION
(25 YEARS OR ABOVE)
HAVING COMPLETED HIGH SCHOOL OR COLLEGE, 1979



Source: General Social and Economic Characteristics, U.S. Summary, Dept. of Commerce, 1980.

that of those nonmetropolitan household heads who did not work, the primary reason reported to explain their absence from the labor force was illness or disability. This is not surprising in light of the high proportion of elderly among the rural poor, and of the physical rigors of rural life.

Consistent with Jesberg's findings, the Housing Assistance Council (21) in reviewing Current Population Survey data found that nearly three-fifths of nonmetropolitan household heads were wage earners in 1979, compared to just over two-fifths of their urban counterparts. They concluded that the rural poor are more typically the "working poor," and that a principal contributing factor to their poverty is the seasonal or part-time, nature of many of their employment opportunities, and the low wages typical of rural areas (21).

Therefore, although they are older, more disabled, of lower educational level and have to travel farther for jobs, the

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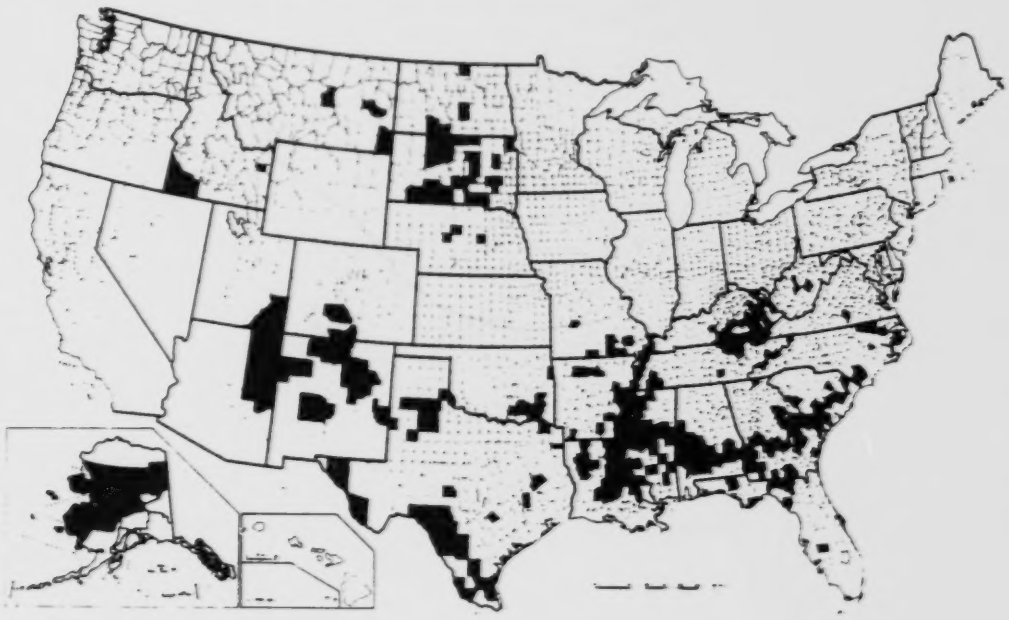
Fig. 2-7

NONMETROPOLITAN COUNTIES WITH A POVERTY RATE OF 25 PERCENT OR HIGHER (1979)



Source: U.S. Department of Commerce, Bureau of the Census, 1980 Census of Population.

rural poor have the highest level of participation in the work force of any segment of the poor population.

Regional Distribution

Rural poverty is most concentrated in the South, including the "Deep South", the Southern Highlands (Appalachia) and much of the Ozark Region and Texas. A pocket of particularly dense, rural poverty occurs in counties bordering either side of the Mississippi River through Arkansas and as far north as Southern Missouri and Illinois. In fact, over one-half the nation's poor are included in the South Census Region (26). Other areas with large numbers of rural poor are those inhabited by Native Americans, predominately Arizona, New Mexico and a large portion of South Dakota. (See Fig. 2-7)

With the exception of Appalachia and the Ozark Regions, minorities bear the worst brunt of rural poverty, especially Blacks, Hispanics, and Native Americans (21).

Geographic Characteristics

The following pages provide a summary of some of the pertinent characteristics of each of the regional pockets of rural poverty throughout the U.S. This information was primarily obtained from Taking Stock by the Housing Assistance Council (21).

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Appalachia

- o High proportions of housing lacking complete plumbing facilities, particularly in Eastern Kentucky and West Virginia
- o Poor housing quality overall
- o Predominately white
- o Limited employment opportunities

Southeast

- o Isolated rural poor black communities often have limited public services, i.e. water and seweage
- o Predominately black; three-fifths of rural blacks who live alone as "individuals" live in poverty as do two-fifths of black rural families
- o Extremely low-wages, and seasonal employment

Rural Native American Settlement Areas

- o Extremely high poverty rates - a third of all rural families and more than one-half of those living alone are poor
- o In some areas over 30% of housing is substandard with few if any public services available
- o Poor salaries and limited employment opportunities

Rural Hispanic Settlement Areas

- o Approximately 25% of families in poverty
- o Many are migrant farmworkers, with seasonal, low paid employment
- o Those migrating spend much of the year in substandard farmworker housing
- o Language and cultural barriers prevent them from using available services

For a more comprehensive discussion of the regional characteristics of rural poverty, see the publication, Taking Stock, by the Housing Assistance Council, Washington, D.C.

Summary of Demographic Profile

- o The rural poor are greater in number than the central city poor
- o The incidence of poverty is higher in rural areas than in metropolitan areas
- o The number of rural poor increased by over 36% between 1979 and 1983

Compared to the metro or central city poor, the rural poor are:

- o less educated
- o more likely to live in two-parent households
- o older
- o more likely to be white
- o more likely to be part of the labor force and thus the "working poor"

Chapter 3

METHODOLOGY

In this section the methods and data sources used throughout the study are presented. Also provided is a brief rationale for the selection of these sources, as well as the nutrition indicators and analytic methods used. A more thorough discussion of several of the indicators is included in the Results section of the report.

Data Included in the Study

Choosing the data sources was the first step in carrying out the study. Because of its large scope numerous types of data were considered for inclusion. An early review of the nutrition survey literature indicated that a thorough evaluation of the nutritional status of a population required examination of the following direct measures of nutrition and nurtrition-linked health outcomes:

1) Parameters of dietary intake of essential nutrients, particularly those known to be especially problematic among the poor

2) Results of biochemical and hemotological laboratory tests of circulating nutrients, or their metabolites

3) Clinical signs indicative of nutritional status, (e.g., skin lesions, glossitis, xerophthalmia, etc.)

4) Anthropometric measures - minimally including height and weight measurements and comparisons to a reference population

5) Indication of the prevalence of nutrition-related health outcomes such as low birthweight, infant mortality, heart disease, and chronic (e.g. cardiovascular) diseases

The literature also suggested inclusion of the following indirect or proxy indicators of nutritional risk:

1) Access to medical care

2) Demand for and utilization of emergency food banks, soup kitchens, etc.

3) Access to and utilization of public food assistance, medical assistance, and income assistance programs

4) The extent of occupied substandard housing

5) Water quality and composition

Recognizing that limitations in time and resources would preclude gathering much of this information, we prioritized each for its availability and potential utility for this study.

Based upon our assessment we chose to include four of the direct nutrition status and nutrition related health outcome measures and one indirect measure. These include:

Direct

1) Dietary intake
2) Biochemical and hematological tests for determination of nutrient status
3) Anthropometric measures (height and weight)
4) Low birthweight and infant mortality rates

Indirect

1) Utilization of food, medical, and income assistance programs

In addition to these indicators of nutritional status, a section describing the principal socio-demographic characteristics of the rural poor is presented as a

separate chapter in this report. The objective of which is to describe the major social and demographic characteristics of the study population.

DIRECT INDICATORS

The source of data for the first three direct measures (dietary intake, biochemical and hematological levels, and anthropometric measures) was the Second National Health and Nutrition Examination Survey (NHANES II). For low birthweight (LBW) and infant mortality (IM), data were collected from state vital statistics offices and from the National Center for Health Statistics (NCHS).

Following is a brief discussion of NHANES II data, including general characteristics of the survey, and the specific methods used to collect and analyze each type of nutrition measure which was included in this study.

I. THE SECOND NATIONAL HEALTH AND NUTRITION EXAMINATION SURVEY (NHANES II)

Rationale

The Second Health and Nutrition Examination Survey conducted by the National Center for Health Statistics (NCHS) in 1976 through 1980 remains the most current, nationally representative nutrition data available. The survey included collection of several lines of nutrition and health data. Survey teams were thoroughly trained, and the data collection methodologies used are widely recognized as high quality, as well as the most rigorous used to date in a survey of its size (41). (Additional information on the methodology, population sample, and survey components of NHANES II, are included in Appendix A at the end of this chapter).

Included in this study were the following components of NHANES II:

1) Dietary Intake of 9 Essential Nutrients (Iron, Vitamins A and C, Thiamin, Riboflavin, Niacin, Protein, Phosphorus and Calcium).

2) Biochemical And Hematologic Tests for Circulating Levels of Nutrients, Their Metabolites, or Their Other Indicator Compounds. (Vitamin A, Vitamin C, Zinc, and Iron*)

3) Anthropometric Indexes, Including Height-for-Age and Weight-for-Height.

Analytic Methods

In analyzing NHANES II data, we both described the prevalence of nutritional deficiencies among the rural poor, and compared their status to that of two reference populations. Further, in orderto obtain an accurate picture of the problems specific to the poor, we used for comparison a group whose access to adequate food was not limited by income. Therefore, the prevalence of nutritional disorders experienced by the rural poor could be compared to a group not encumbered by the inability to purchase adequate amounts of food.

For this purpose, we selected the U.S. population reporting incomes of at least two times the official poverty threshold during the year they were examined (in 1979 this amounted to an income of at least $14,824 for a family of four--before taxes). (Poverty thresholds are presented in Appendix B).

In addition to this reference group, the rural poor were also compared to a group consisting of rural persons who lived in

* Separate tests for iron were employed, including; hemoglobin, percent transferrin saturation, and mean corpuscular volume (MCV).

households reporting incomes of at least twice that of the poverty threshold (the rural reference population).

Following is a description of the study population (rural poor) as well as the two groups whose data were included for comparison.

1. **Rural Poor Residents (RP)**
   This group consists of those individuals in nonmetropolitan areas who lived in households with reported incomes below the poverty threshold. (The poverty threshold in 1979 for a family of 4 was $7,412.00 per year before tax. In 1984 it was $10,609.00).

2. **Rural Nonpoor Residents (RNP)**
   This group consists of those in nonmetropolitan areas who lived in households with reported incomes that were at least two times the poverty level. In 1979 a family of four living at two times the poverty level earned $14,824.00 per year before tax. In 1984 it was $29,648.00.

3. **U.S. Nonpoor Residents (U.S. NP)**
   Same as for RNP except includes metropolitan and nonmetropolitan residents.

Statistical Methods

In order to estimate the probability that the differences observed between each group (rural poor, rural nonpoor, U.S. nonpoor) would be expected under the terms of the null hypothesis, sample weights were applied to the actual numbers sampled and a chi square test was used*. This involved converting the actual recorded values, and their means for consumption, biochemical levels, and anthropometric measures, into a binomial distribution (values below-and values above selected cutoffs). This was done for the total U.S. analyses only since regional analyses often included a very small sample size.

Geographic and Racial Analysis

In order to better understand which geographic regions and racial groups were at greatest and least risk, we also conducted the above analyses and comparisons separately for the four geographic regions into which NHANES II data can be broken down (these are listed in Appendix C), and by white/nonwhite racial categories.

Following is a discussion of each of the three specific direct data components included in this study (dietary intake, biochemical tests, and anthropometric indices). It includes the rationale for their inclusion and their primary strengths and weaknesses as nutrition status indicators.

A. DIETARY INTAKE

Rationale

Studies of dietary intake are a critical component of most nutrition assessment surveys. They are used to determine both the quantities of nutrients consumed by an individual or group, and the sources of those nutrients. Therefore, they establish a knowledge base which can help explain health related problems or conditions experienced by individuals or by a larger population. In addition, identification of particular nutrients as potential problems, based upon either very low or abnormally high intake, is of great utility in alerting the food, health, and nutrition communities of increased risks to the public health (33). On the basis of such information, action may be taken which can minimize the consequences of persistent nutrient imbalances.

While dietary intake studies are an integral component of most studies of nutritional status, their results are

* Limitations in our statistical design precluded consideration of the design effect of the NHANES II survey in our statistical analyses.

often misinterpreted and misused. Results from such studies should not be interpreted as conclusive determinants of nutritional status (33). Rather, they provide supporting and or presumptive evidence of nutritional inadequacies or excesses among individuals or population groups. These limitations will be discussed further in the following section of this chapter.

Methods of Data Collection and Analyses

Selection of an appropriate method for collecting and analyzing dietary intake information is a critical step toward the generation of desired and accurate dietary data.

In their article on problem nutrients in the U.S., Pao and Mickle warn of a seldom acknowledged analytic limitation which results from the use of mean intakes in the study of dietary status. "Means conceal the wide variations in intakes. Furthermore, they tend to overestimate nutrient levels because an intake that exceeds the RDA several-fold cannot be compensated for by an intake below the RDA" (28). Yet, despite these limitations, this is exactly the approach most often taken by NCHS, USDA and other researchers.

Selection of Cutoffs

In order to interpret NHANES II nutrient consumption data for this study, we selected the most recentversion of the recommended dietary allowances (RDA) as the standard.* We chose to establish 67% (approximately two thirds) of the RDA as the cutoff point. Selection of this level resulted from our decision to have greater confidence that those failing to attain the cutoff were truly at increased risk of deficiency.

According to the Food and Nutrition Board of the National Research Council (the group responsible for establishing the RDAs), when the proportion of individuals with low intake is high, the risk of nutritional deficiency among that group is increased (29). Many studies have selected either 80%, 75% or 2/3 of the RDA as a cutoff, designating those with intakes below these levels at increased risk of deficiency (30). We have thus selected the low-end as our indicator of increased risk.

From the 24-hour recalls of dietary intake conducted in NHANES II, we analyzed levels of consumption for nine essential nutrients (as previously described). Intake was computed for each individual and expressed in terms of the percentage of the 1980 RDA for his/her sex and age category. These percentages were then compared to the 67% marker which was selected to discriminate between those at higher risk of experiencing a deficiency and those at lower risk.

Comparison of Results

In order to determine whether the diets of the rural poor were less adequate than those of the population at large, we compared the percentage of the rural poor who reported consuming less than 67% of the RDA for their age and sex group for each of the nutrients measured, to that of the two non poor groups. A chi square test was then conducted for each nutrient to determine whether the observed disparities between the groups were statistically significant. These analyses were made for

the entire rural poor sample, for the rural poor in each region, and for two racial categories among the rural poor (white and nonwhite).

It is critical to recognize that, while consuming below the cutoff for a nutrient or number of nutrients is not a definitive marker of deficiency, when used as a means of comparison of relative risk between groups this method is extremely useful.

24 Hour-Recall

The 24-hour recall method is probably the most commonly used dietary intake methodology and was the method used in NHANES II. (31). It offers the advantages of being relatively unobtrusive, takes only 15-20 minutes and does not require an exceptional memory span. When conducted properly (that is when the interviews are not previously announced) the likelihood that subjects will modify their food habits is minimized.

Inappropriate conclusions about nutritional status based on the 24-hour recall are common, and are usually based upon the fact that the recall is not necessarily representative of typical consumption. Smicklas-Wright and Guthrie (31) add that "the interpretation of data from any one of these types of days as typical is one of the most obvious limitations of a 24-hour recall, especially when used with individuals." They add that "when it is used to assess intakes of groups, the assumption is that there is a greater likelihood of balancing out deviations from the more typical intakes". For this reason, while the 24-hour recall is a very limited tool for examining intakes of individuals, it is considered a strong method for determining estimates of group average intake for large groups of subjects (usually 50 or more subjects is considered adequate) (31,32).

Although dietary methodologies, regardless of the specific type, have many other inherent limitations, we will not elaborate upon them further here. The 24-hour recall remains the primary method used in most recent large surveys. Its proper interpretation can provide a wealth of dietary intake information, particularly on large groups.

B. BIOCHEMICAL AND HEMOTOLOGICAL TESTS

Rationale

The measurement of levels of nutrients in the body by use of laboratory methods can greatly enhance our knowledge of an individual's nutritional status. Biochemical measures offer a very direct, objective and precise method of nutritional assessment, which can greatly increase our ability to detect nutritional risk or deficiency prior to the development of overt clinical outcomes.

Usually, nutrient levels in biological fluids (blood or urine) are measured. However, for some nutrients, evaluation is based upon the level of activity of certain biochemical functions which are dependent upon an adequate supply of particular nutrients. Laboratory tests generally have two objectives in a nutrition survey. First, they are often used to detect marginal nutritional deficiencies. In this case, their utility is in identifying

individuals or population groups before overt clinical signs appear. Their second objective is either to support, supplement or follow-up on other studies such as dietary methodologies, or more general community health assessments (33-35).

Interpretation of Data

Interpretation of laboratory data on nutrient status is a controversial topic. For many nutrients, consensus has not yet been reached on acceptable laboratory methods or on the interpretation of their results. This lack of consensus stems primarily from the very objectives of the tests themselves-that of identifying risk of deficiency before it is manifested clinically. Therefore, accuracy of interpretation cannot simply be carried out by clinical evaluation. It must also be recognized that although we frequently resort to terminology such as "at nutritional risk", as yet there are no empirical data available which allow us to assess the significance or the potential severity of this "risk".

The ability of biochemical tests to predict the likelihood that an individual or a group will develop evidence of malnutrition related disease is still debated. Nevertheless, when tests are properly conducted, the information which they provide remains the most direct and often the most accurate assessment of the nutritional status of an individual, or of a population group. Moreover, they offer the possibility of corroborating the findings based upon studies of dietary consumption with those based upon physical data (biochemical levels).

Selection of Cutoffs

Selection of appropriate lower bounds for acceptable biochemical or hematological levels is of obvious importance in the interpretation of test results. Unfortunately, consensus among the medical and nutritional communities in this area has been particularly elusive (34).

For this study, widely accepted, biochemical cutoff levels which have been used in large, well known surveys were selected. Individuals whose levels fell below these cutoff values for their age/sex group are at an increased risk for suffering the consequences of deficiency.

In the selecting of values for use in this study, our primary objective was to select values which:

- o are current
- o have been routinely used by other researchers
- o are middle-of-the-road in that they will not result in excessively high prevalences of deficiency nor excessively low prevalences. These considerations resulted in the values presented in Table 3-1 (the sources are also provided)

Analysis of Data

The same basic comparative procedures were used in the analysis of biochemical and hemotological data as were used for dietary intake. However, instead of using 67% of the RDA criterion, standard biochemical cutoffs were selected for each nutrient studied (depending on the age and sex of the subject). The percentage of individuals with levels below these cutoffs were compared. The chi square test was again applied to determine the extent to which the observed disparities between the groups were significant statistically.

C. ANTHROPOMETRIC MEASURES

Rationale

Anthropometric measurements, including

TABLE 3-1

BIOCHEMICAL CUTOFF LEVELS FOR SPECIFIED NUTRIENTS

Nutrient	Age (in years) of subject	Acceptable Values		
		Males & Females	Males	Females
[1]Hemoglobin (gm/100 ml)	1-2	≥10.9	--	--
	3-4	≥10.9	--	--
	5-10	≥11.2	--	--
	11-14		≥12.0	≥11.8
	15-19		≥13.1	≥11.7
	20-44		≥13.4	≥11.9
	45-64		≥13.2	≥11.8
	65-74		≥12.6	≥11.9
[2]Mean Corpuscular Volume (fl)	1-2	≥73		
	3-4	≥75		
	5-10	≥76		
	11-14	≥78		
	15-74	≥80		
[3]Percent Transferrin in Saturation (%)	1-2	≥12		
	3-4	≥14		
	5-10	≥15		
	11-14	≥16		
	15-74	≥16		
[4]Serum Ascorbic Acid Vitamin C (mg/100 ml)	All Ages	≥30		
[5]Serum Vitamin A (mg/100 ml)	6 months to 17 years	≥30		
[6]Serum Zinc (ug/100 ml)	All ages	≥70		

[1]Values were estimated by the National Center for Health Statistics for whites only, using the methods of Dallman et al.

[2]Assessment of Iron Nutritional Status of the U.S. Population, Life Sciences Research Office, based on data collected in the Second National Health and Nutrition Survey, Editors: Pilch, S., Senti, F., Federation of American Societies for Experimental Biology, Bethesda, MD, 1984.

[3]Ibid.

[4]Sauberlich, H. Current Laboratory Tests for Assessing Nutritional Status Survey and Synthesis of Pathology, Research, 2:120-133, 1983.

[5]Ibid.

[6]Assessment of Zinc Nutritional Status of the U.S. Population, Life Sciences Research Office, based on data collected in the Second National Health and Nutrition Survey, Editors: Pilch, S., Senti, F., Federation of American Societies for Experimental Biology, Bethesda, MD, 1984.

measurements of height, weight, and proportions of the body have long been used as indicators of nutritional status. For children in particular, physical growth is one of the best and most practical measures of nutritional status (34). While debate continues over the degree to which different environmental factors, especially nutrition, outweigh the importance of genetic variables, there is widespread consensus that nutrition plays a vital role in determining growth--particularly in young children (33-35).

The following section includes a brief review of the interpretation of the anthropometric indicators addressed in our study.

1. Height-for-Age

Rationale

Height-for-age is widely used as an indicator for diagnosing nutritional status in children. Its utility lies in its ability to reflect nutritional status over time. Linear growth retardation (growth stunting) does not result from an acute, short-term episode of undernutrition. Rather, it occurs after prolonged or recurrent episodes of nutritional deprivation (35). This, combined with ill health or chronic parasitic infestation (often due to an unsanitary environment or poor source of water) may retard normal growth, particularly during early childhood. Although some of this deficit may be made up for during subsequent years under conditions of optimal health and nutrition, complete recovery may not occur, particularly if the nutritional deprivation persisted over long periods (36).

Numerous national and state surveys conducted in the U.S. have reported varying prevalences of stunted growth among low income populations (9,11). Data from the Center for Disease Control's (CDC) Pediatric Nutrition Surveillance System concluded that of 336,000 low-income children (from 28 states and the District of Columbia) screened in 1982, approximately 10 percent of the children 3 months to 5 years, were low height-for-age (9). Results of the Massachussetts Nutrition Study in which 1429 low-income children were surveyed supported CDC's findings (9).

Furthermore, those impacted sufficiently to limit the extent to which they reach their genetic potential represent only a small proportion ofthose children impacted by nutritional deficiencies. Studies on the physiological adaptation to hunger and under-nutrition among children have consistently observed that the initial stage involves a decrease in activity level (15,35,37). This adaptive mechanism serves to help the child maintain normal body functions, including growth during periods of insufficient nutrition. However, the cost to the child is a decrease in activity, which leads to a slowing of the child's cognitive development, as a result of decreased interaction with his/her environment. However, it is not until under-nutrition has persisted for some time, that the child's stature is affected.

Three key points should be noted regarding the interpretation of growth stunting data:

1) Its very existence indicates that a far more prevalent underlying condition of nutritional deprivation is likely to exist among the population.

2) By the time a child's height attainment has been affected, chronic malnutrition has probably already undermined the child's

social and cognitive development.

3) It is commonly believed that differences in stature between ethnic groups are genetically based. However, a recent abundance of evidence is emerging which suggests that nutrition can be equal to, if not more important than, heredity in determining stature (36). It appears that socio-economic characteristics, rather than heredity, account for much of the variability in height attainment observed among minority children. Christakis warned of this in his publication on nutritional assessment for the American Public Health Association when he stated that "socio-economic status will be found to correlate positively with nutritional status. Many differences in nutrition findings that appear to be a reflection of ethnic differences are, in fact socio-economically determined. Specific results should be related only to the age group under study and not over-interpreted or extended to some larger population group or community" (34). In a similar vein, Dr. Frederick Trowbridge, Director of the Nutrition Division at the Center for Disease Control in Atlanta, at a recent conference in Washington D.C.responded to a question regarding ethnic differences in stature with the following remark, "we do not view ethnic groups differently. Attainment of optimum stature depends far more on nutrition and environmental factors than upon ethnic factors" (38). In summarizing the results of numerous studies on this subject, Mortorell and Habicht concluded that the variation in height which can be attributed to the environment is several times as great as that which results from genetic differences (36).

Methods

For this study, only NHANES II height measurements of children 6 months to 18 years of age were included. Recumbent length was used for children up to 36 months, since children younger than this often have problems standing straight.

In order to interpret the height-for-age data, comparison to a reference population was required. To accomplish this, we selected the NCHS growth curves as our reference. These curves are derived from studies conducted by the Fels Research Institute (for ages 0-36 months) and from 2 cycles of the Health Examination Surveys and NHANES I, conducted by NCHS.

Recreating these growth curves required using a set of algorithms which were supplied to us by NCHS. Since the expected proportion of individuals below the fifth percentile is five percent, of concern are those groups with values above this level.

Comparison of height-for-age data from rural poor children and from each of the two groups of nonpoor children studied were compared to the fifth percentile curve of the reference population. Comparisons were made of the percent below the reference curve from each group (rural poor, rural nonpoor, U.S. nonpoor).

The fifth percentile of height-for-age is generally accepted as the level below which the risk of growth stunting having occurred is greatly increased. It was therefore used in this study both to indicate the prevalence of growth stunting among rural poor children,and to compare their status to that of nonpoor children.

Results of these comparisons were tested for significance using the chi square test as previously described.

Weight-for-Height

Rationale

Since stature responds slowly to sudden changes in the nutritional environment, the height-for-age index is not the appropriate tool for monitoring nutritional status over the short term. Rather, the weight--for-height index is often used to indicate the recent or short-term level of nutritional adequacy.

Weight-for-height is an index which relates body mass to stature. Acute episodes of nutritional deprivation may result in gross weight loss, often referred to as "wasting". The other extreme, "obesity," is characterized by an abnormally high weight-for-height ratio. Since the weight-for-height index is responsive to short-term fluctuations in dietary adequacy, it is considered a measure of an individual's present nutritional status (30,34).

Methods

Similar to height-for-age, interpretation of the weight-for-height index involved comparison to a standard "reference" population. As with height-for-age, the NCHS reference curves were used. However, for this index, males from 6 months to 11 years and females from 6 months to 10 years were included. Those children falling below the fifth percentile were considered to be at increased risk for wasting. Those above the ninety-fifth percentile were likely to be grossly overweight, and at increased risk for the health complications of obesity. Again since the expected proportion with weight-for-height below the fifth or above the ninety-fifth percentiles is five percent, of concern to us are those groups in which greater than five percent fall into either of these categories. Results for these analyses were compared and tested for significance, again using the chi square test.

II. LOW BIRTHWEIGHT AND INFANT MORTALITY

Rationale

Because of its ability to quickly respond to changes in the socio-economic and health care environments, and its association with inadequate nutrition, (mediated primarily through low birthweight) infant mortality data is an ideal indicator of health and nutritional status.

Low birthweight data was included in the study because of its close relationship to maternal nutritional status. The probability of bearing a low birthweight child is known to increase when maternal nutrition is less than optimal. Both pre-pregnancy weight and weight gain during pregnancy are key determinants of fetal growth. Therefore, low birthweight is widely considered an important indicator of nutritional status.

A considerably more thorough discussion of the link between nutrition and these two outcome indicators is presented in the IMR and LBW Results section.

Methods of Data Collection and Analysis

Time Frame

Analysis of low birthweight (LBW) and infant mortality (IM) data provided the ability to move from non-time series data (that of NHANES II), to data which was collected consistently over repeated years (time-series). Therefore, unlike our approach to NHANES II data, our analysis of LBW and IM addressed the changes which occurred over the time of the study period. In addition, whereas maximum geographic resolution in NHANES II data was at the

level of the region (i.e., Northeast) IM and LBW data are available at the state and county levels.

We selected the 1980's for our study period for two primary reasons:

1) We were interested in the most current nutrition status information available in order to address the question; "What is the current nutrition status of the rural poor?" and,
2) Beginning in 1981 there were major changes in federal food assistance policies and in other programs which serve our nation's poor. These changes coincided with an economic recession (and subsequent increases in the number of poor who were not served by these programs).

Data Sources and Rationale for Criteria

County-specific live birth, IM, and LBW data for 1980-1983 were collected, by place of residence, from the 85 poorest rural counties in the U.S. For the purpose of this section of the study, rural poor counties are defined by the following two criteria:

1) A county which is not included in a standard metropolitan statistical area (SMSA)*.
2) A county in which at least 33 1/3 percent of residents were below the poverty level in 1979. (Refer to Appendix A in Chapter 7, for a list of the 85 counties which met the above criteria).

It is worth noting that of the 86 counties that met the poverty criteria, all but one (Hidalgo, Texas) were nonmetropolitan.

These criteria were employed because:

- only counties in which there are no cities with populations above 50,000 are included, and,
- they identify only those counties with the highest poverty rates in the nation.

The raw data were provided by the National Center for Health Statistics (NCHS) from their 1980-1982 natality and mortality tapes with the following exceptions:

1) Since NCHS still only reported a 50% natality sample in 1980 for three states involved in our study in 1980 (AZ, NM, GA) and two in 1981 and 1982 (AZ, GA), we used state-reported natality data for those states when available. This included live births and low birthweight, but not infant mortality data.
2) 1976-1980 summary data were provided by the Maternal and Child Health Studies Project of Information Science Research Institute for use by the Public Health Service.

1983 final state data were provided by each respective state's vital statistics office. These data were most often provided in published annual vital statistic summary books, but were sometimes provided in the form of unpublished reports, specifically prepared by the state for our study.

These data include: live births, infant mortality, and low birthweight births. As the county specific data represent small numbers of births and deaths, the county data were totaled to determine the aggregate numbers andrates for the 85 poorest rural counties. The data were also aggregated by race (white, nonwhite, and black). It is these aggregate figures which are

* The 1974 SMSA criteria were used.

analyzed in this report.

While data for blacks were collected and analyzed in this section of the report, the study does not include 1983 IM or LBW data for blacks because they were unavailable to us. Therefore, analyses of black trends do not include 1983 information.

Limitations in Study Design

The inability to link income data to IM or LBW data results in a limitation in our analyses regarding the rural poor. Rather than representing the rural poor, (as do the NHANES II data) IM and LBW data used in this study represent data from entire counties each having at least one third of its residents living in poverty (in 1979).

Therefore, low birthweight and infant mortality rates experienced by the poor in these counties are actually "diluted" by those of the counties' nonpoor residents. Nevertheless, data from these counties do represent the highest concentration of rural poor birth outcome data available.

It follows that within the rural poor counties studied, lower prevalences or downward shifts in the IMR or LBW rate which are experienced by nonpoor residents would negate much of the higher rates or worsening trends experienced by poor residents. In addition, since the nonpoor population exceeded that of the poor in most of the counties observed, data from the nonpoor tended to outweigh that of the poor. This limitation in our study design has the likely result of minimizing the real gap in LBW rates and IMRs between the rural poor and the nonpoor.

Statistical Methods

Since the raw data provided true and complete measures of the population parameters of interest (such as the proportion of white infants in rural poor counties who died before their first birthday), statistics played a minor role in the description and estimation of the population parameters. Instead, they were used to assign probabilities to the observed differences between the rate experienced by rural poor county residents and that experienced by the rest of the U.S. population.

For this purpose, a simple test for the significance of the observed difference between proportions was applied to the pairs of proportions that were compared (e.g. the rate of IM occurring in rural poor counties versus that occuring in the rest of the country). (Refer to Appendix D at the end of this section for a description of the statistical methodology employed).

The only other manipulation involved estimating the 1983 race-specific low birthweight frequencies for South Dakota, because the actual figures were unavailable. We did this by averaging the ratios of LBW of each race from 1980-1982 and applying these to the 1983 total LBW number (which was available).

III. NATIONWIDE FOOD CONSUMPTION SURVEY (NCFS)

Although the USDA's NCFS contains a wealth of data on consumption patterns of the rural poor, we chose only to use its analyses as supplemental or supporting information because a great deal of intake data were already availablefrom NHANES II. We determined that, since NHANES II biochemical and anthropometric data was being used, it would be more consistent to rely on NHANES II as the primary source of dietary data as well.

The NFCS data included were prepared in August, 1982 by the Consumer Nutrition

Information Center, of the Human Nutrition Information Service at USDA (20). Data is from the first low-income supplemental survey of the NFCS (1977-1978). This survey included three day food and nutrient intakes of over 12,000 low-income individuals residing in the 48 coterminous states. Low-income was determined by eligibility for the Food Stamp Program*

INDIRECT INDICATORS

We called upon several sources in collecting program participation data for food, health and income assistance programs. While the Census Bureau's Current Population Report (1) provided the majority of the data, information on the distribution of program costs was also collected from the Bureau of Economic Analysis' Regional Economic Information System (25).

Rationale

The level of utilization of food, health, and income assistance programs by the poor also serves as a tool to help assess and predict the health and nutrition status of a population--albeit an indirect one.

The rationale for its utility in this role comes from the very way we determine poverty, (i.e., the inability of a household to afford the basic standard of living). Only if other necessary living costs are neglected or provided for by a source outside of the household unit can an impoverished household afford adequate amounts of food. Therefore, the percent of the poor who receive program benefits, whether in-kind or cash, and the per capita value of those benefits, provides critical information on the percent who are at significantly increased risk of experiencing nutritional deprivation due to inadequate financial resources. We chose to examine data from the years 1979-1983 when available, since they were the most current at the time of the study. Along with poverty data, we perceived that an analysis of recent trends in program participation might also be useful in helping to predict changes in nutritional status which have occurred among the rural poor in recent years.

Analytic Methods

Program participation and benefit levels among the rural poor and in some cases, urban poor were collected and analyzed. For the majority of analyses, participation levels among the rural poor were compared to levels among the urban poor. For other analyses, the number of rural poor residents unserved by the various programs examined, were analyzed for the period from 1979-1983. Still for others, analysis of the amount of assistance program expenditures which were received by rural compared to metropolitan residents were examined.

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* Eligibility for the Food Stamp program is not consistent with the federal poverty definition. Besides income and asset determinations, certain deductions are calculated. Nevertheless, for the purpose of interpreting NFCS data, eligibility for the food stamp program can be used to discriminate between the poor and nonpoor, in a gross manner.

Appendix A

Description of National Health and Nutrition Examination Survey, NHANES II, 1976-1980

NHANES II was conducted between 1976 and 1980 on a national probability sample of 28,000 persons, age 6 months-74 years, from the civilian noninstitutionalized population of the United States. The survey intentionally oversampled certain population groups thought to be at high risk of malnutrition (the elderly, the poor and pre-school age children) in order to improve the statistical reliability of data from these groups.

In addition, since NHANES II used a multi-stage rather than a simple random sample, it was necessary to apply appropriate sample weights for each person sampled-in order to properly analyze the data.[1] The sample weight took into account selection probability, adjustments for non-response, and post-stratification. A total of 20,322 persons were interviewed, examined, and included in the survey (41).

NHANES II data included information on: demographic variables, dietary history and dietary intake, medical history, anthropometry, hemotological and nutrient biochemistry laboratory tests as well as other health information less pertinent to our study.

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[1]It is critical to note that the application of calculations and statistical tests appropriate for a simple random sample to NHANES II can lead to serious misinterpretations.

Appendix B

Poverty Thresholds For Persons Living Alone And For A Family Of 4: 1979-1984

Year	Single Person	Family of 4
1979[1]	$ 3,689	$7,412
1980[1]	$ 4,190	$8,414
1981	$ 4,620	$9,287
1982	$ 4,901	$9,862
1983	$ 5,060	$10,180
1984	$ 5,280	$10,609

Source: U.S. Dept. of Commerce (Bureau of the Census)

1. Until 1981 farm and non-farm families poverty thresholds were calculated separately for farm and non farm families. We have only included non-farm.

APPENDIX C

Regional Classification Used by NHANES

Region	States Included
Northeast	Maine, Vermont, New Hampshire, Massachusetts, Connecticut, Rhode Island, New York, New Jersey, and Pennsylvania
South	Delaware, Maryland, District of Columbia, West Virginia, Virginia, Kentucky, Tennessee, North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, and Arkansas
Midwest	Ohio, Illinois, Indiana, Michigan, Wisconsin, Minnesota, Iowa, Missouri
West	Washington, Oregon, California, Nevada, New Mexico, Arizona, Texas, Oklahoma, Kansas, Nebraska, North Dakota, South Dakota, Idaho, Utah, Colorado, Montana, Wyoming, Alaska, Hawaii

Appendix D

Analytical Methods-LBW and IMR

Since the raw data provided true and complete measures of the population parameters of interest (such as the proportion of of white infants in rural poor counties who died before their first birthday), statistics played a minor role in the description and estimation of the parameters. Instead, they were primarily used to assign probabilities to the true differences observed in the population parameters.

For this purpose, a simple test for the significance of the observed difference between proportions was applied to pairs of proportions that were compared. When testing the differences between proportions, a common formula for relating this difference to a standard normal deviate was used. The null hypothesis was always that p1-p2 = 0 (i.e. rural poor county rates were equal to the rest of the nation's rates).

Assuming this to be true, the observed proportions were pooled to yield the best estimate of the true common proportion

(p). The formula for calculating this common proportion is:

$$P = \frac{X1 + X2}{R1 + R2}$$

Where,

P = common proportion

X1 = Number of "positives" in category 1 (such as low birthweight infants in non-rural poor counties)

N1 = Number of live births in category 1

X2 = Number of "positives" in category 2

N2 = Number of live births in category 2.

This estimate of the common proportion was used to estimate the variance of the differences between the proportions. This was calculated as follows:

$$\sigma^2_{p_1-p_2} = \left(\frac{\bar{p}\bar{q}}{n_1} + \frac{\bar{p}\bar{q}}{n_2}\right)$$

where q = 1 - p and all other symbols represent the quantities previously described. The standard normal deviate was then calculated from these estimates:

$$Z = \frac{p_1 - p_2}{\sqrt{\frac{\bar{p}\bar{q}}{n_1} + \frac{\bar{p}\bar{q}}{n_2}}}$$

Probabilities corresponding to the derived standard normal deviates were looked up in a table of normal curve areas.

The only other manipulation involved inputting the 1983 black, white and nonwhite low birthweight frequencies for South Dakota, due to their unavailability. We did this by averaging the ratios of low birthweight births from each of these three racial categories for the state from 1980-1982 and applying the 1983 total LBW number.

Chapter 4

DIETARY INTAKE

RESULTS OF NHANES II ANALYSES

PRESENTATION OF DATA FROM NHANES II

In order to both illustrate and explain the findings from the analysis of NHANES II data on dietary intake, nutritional biochemistry, and anthropometric indices, our results are presented in the following format:

1) The data are divided into three sections (dietary intake, nutritional biochemistry, and anthropometry).

2) Within each section the results for each specific indicator examined are presented individually.

3) For visual comparison, bar graphs are also presented.

4) Each section also includes a summary table of the nutrients or indicators addressed in that section. The table includes information on the percentage of rural poor who failed to reach the specified cutoff level for that nutrient or indicator, and the percentage of U.S. nonpoor residents who fell below the cutoff. The weighted number of individuals sampled is also provided. These data are presented for the total U.S., for four regions of the U.S. and for total races, whites, and nonwhites.

A second table includes similar information, however, it compares data from the rural poor to that of the rural nonpoor, rather than to the total U.S. nonpoor population.

Analytic Limitations

The National Center for Health Statistics (NCHS) suggests that descriptive statistics generated from observation of less than 45 subjects are likely to be unstable and unreliable. Therefore, caution must be taken when interpreting data which is disaggregated into racial and regional subgroups because of the resulting small sample sizes. In addition, due to the very small number of rural poor nonwhites who were sampled in each region, (except in the South*) nonwhite data from the Northeast, Midwest and West are likely to be unstable and therefore not highly reliable nor representative.

Similarly, inferences based upon anthropometric data, or that of serum vitamin A (in which only limited age-groups were examined) should be made with caution.*

DIETARY INTAKE RESULTS

Introduction

In this section, we present the results of the analyses of NHANES II dietary intake data for nine nutrients. The nutrients included are: Vitamin A, Calcium, Iron, Vitamin C, Thiamin, Niacin, Riboflavin, Phosphorus, and Protein. The results of these analyses are presented individually and then compiled in Tables 4-1, 4-2. Included

* Due to the large proportion of the impoverished population in the South which is compromised of nonwhites, significantly greater numbers of nonwhites were included in the survey's Southern population sample.

* Due to small sample sizes at the regional level, tests for statistical significance were carried out and presented for national comparisons only.

in each table is a comparison of the percent of the rural poor and the nonpoor comparison group who consumed less than 67% of the RDA for each nutrient. The weighted numbers of persons sampled are also included. In addition, statistical significance of the differences between the percentage of rural poor and nonpoor who consumed below that level are indicated as well .

RESULTS

VITAMIN A

TOTAL RACES

48.0% of the rural poor consumed less than 67% of the RDA for this nutrient. This compares to 41.6% of the rural nonpoor population, and 38% of the U.S. nonpoor population. The differences between the rural poor and those with adequate income are statistically significant ($p<.0001$). (Refer to Fig. 4-1 and Tables 4-1 and 4-2).

Whites

While 49.0% of rural poor whites failed to consume 67% of the RDA, 41.6% of rural nonpoor whites, and 38.3% of the entire U.S. nonpoor white population failed to meet this level.

Nonwhites

44.7% of rural poor nonwhites, 40.5% of rural poor nonwhites, and 42.2% of U.S. nonpoor nonwhites consumed less than 67% of the RDA for this nutrient.

DISCUSSION

Our data demonstrate that Vitamin A is a problem nutrient among the rural poor. While it has been reported as a problem nutrient for the general population, the rural poor have an approximately 25% higher likelihood of falling below the cutoff for this nutrient than do the U.S. nonpoor. While both nonwhites and whites have similarly inadequate intakes, consumption of this nutrient appears to be significantly more income-related among whites than among nonwhites. Geographically, it appears again that the rural poor of the Northeast are least at risk, while the rural poor in the West are at greatest risk.

CALCIUM

TOTAL RACES

43.6% of the rural poor failed to consume 67% of the RDA for calcium. This compares to 39.6% of rural nonpoor residents and 38.1% of the U.S. nonpoor population. The differences between the rural poor and those with adequate income are statistically significant. ($p<.0001$) (Refer to Fig. 4-2. Tables 4-1, 4-2)

White:

40% of rural poor whites consumed less than 67% of the RDA, compared to 38.8% of rural nonpoor whites, and 36.5% of the U.S. nonpoor white population.

Nonwhite:

55.5% of rural poor nonwhites consumed below 67% of the RDA for calcium. This compares to 49% of the rural nonpoor nonwhite population and 50.2% of the U.S. nonpoor nonwhite population.

DISCUSSION

Our data indicate that inadequate consumption of calcium is a serious problem among the rural poor. This is particularly true for rural poor nonwhites, of whom more than 55% failed to consume two-thirds of the RDA for this nutrient. It should also be noted that high prevalences of inadequate calcium intake were not limited only to the rural poor, but were observed in each group studied. Those groups with the highest prevalence of inadequate intake included rural poor non-whites in the South and West, where 62.6% and 55.1%

Fig. 4-1 Percent of Individuals Who Consumed Less Than 67% of the RDA for Vitamin A

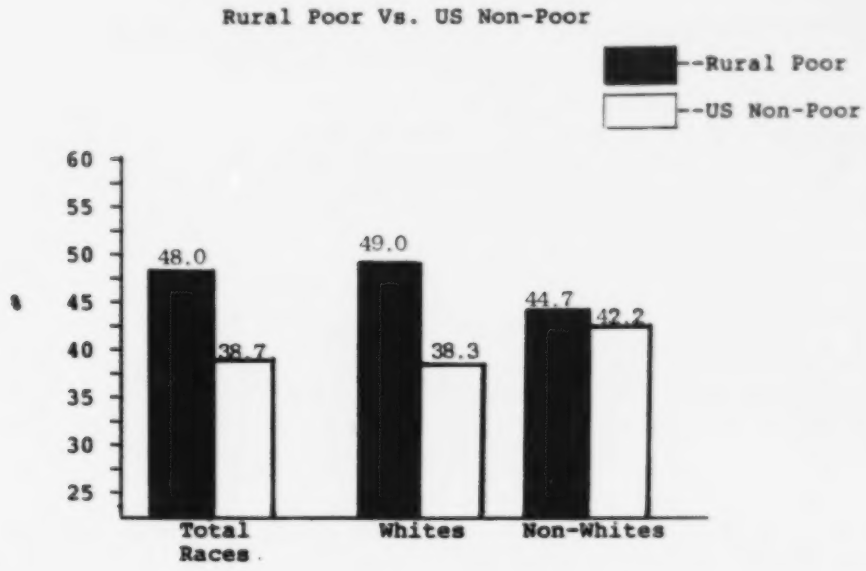
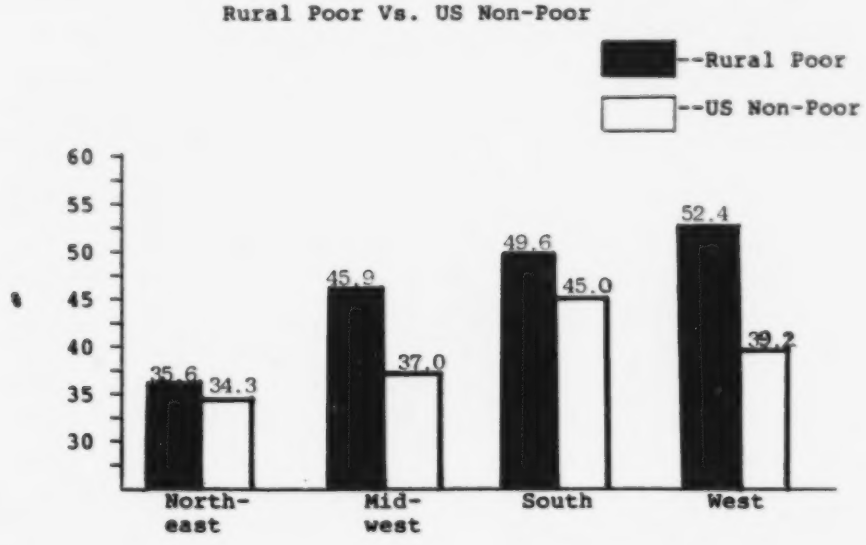


Fig. 4-1 Percent of Individuals Who Consumed Less Than 67% of the RDA for Vitamin A



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consumed less than the cutoff level. The lowest risk group appeared to be whites living in the Northeast, whose prevalence of inadequate consumption was below 40%. The gap between rural poor and nonpoor was of greatest magnitude in the West where 51.7% of the rural poor compared to 33.8% of the non-poor population consumed less than 67% of the RDA for calcium.

In light of recent evidence linking inadequate calcium intake to increased risk for osteoporosis, the severity of the findings are of increased interest.

failed to consume that level. The differences between the rural poor and those with adequate income are significant ($p<.0001$). (Refer to Fig. 4-3, Tables 4-1, 4-2).

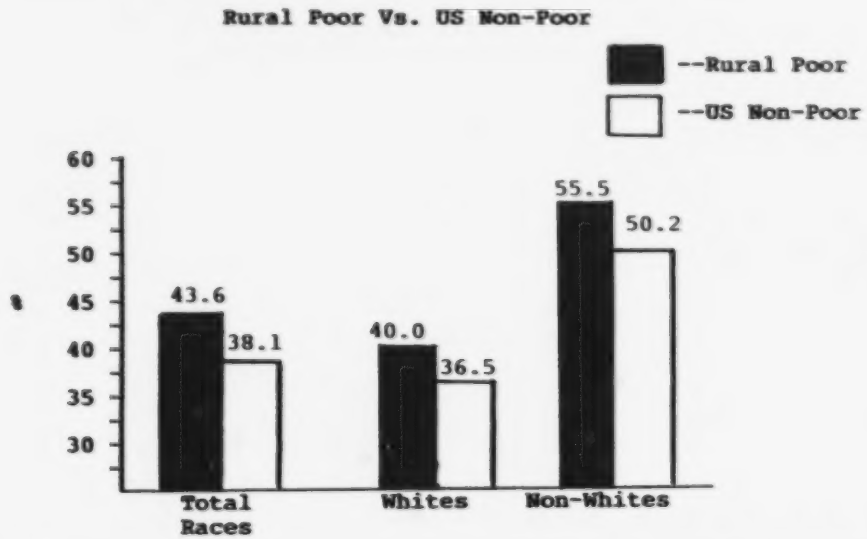
White

42.3% of rural poor whites consumed less than 67% of the RDA, compared to 32.1% of rural nonpoor whites and 30.7% of the total U.S. nonpoor white population.

Nonwhite

47.9% of rural nonpoor nonwhites consumed less than 67% of the RDA for iron, compared to 32.7% of the nonwhite rural nonpoor

Fig.4-2 Percent of Individuals Who Consumed Less Than 67% of the RDA for Calcium



IRON

TOTAL RACES

Whereas 43.6% of the rural poor failed to consume 67% of the RDA for iron, only 32.2% of rural nonpoor residents and 31.3% of the entire U.S. nonpoor population

population and 36.3% of the U.S. nonpoor nonwhite population.

DISCUSSION

These data demonstrate that inadequate consumption of iron by the rural poor is a significant problem. The extent of the

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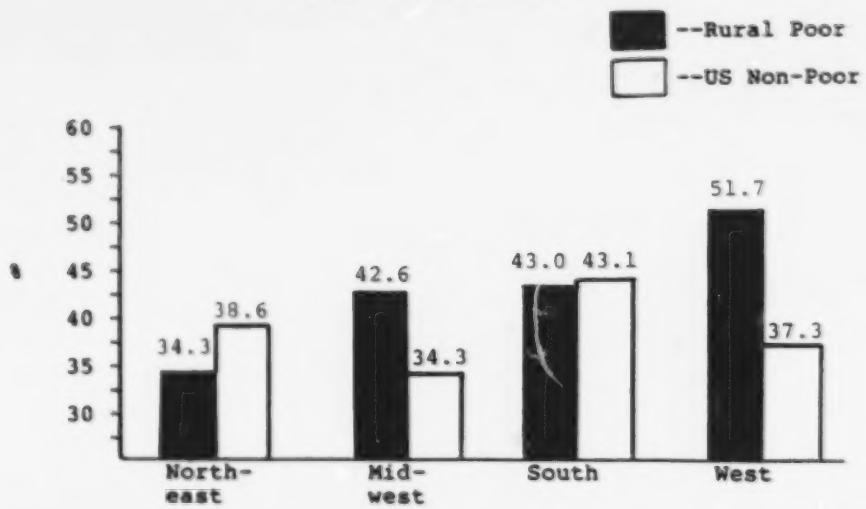
disparity between the rural poor and the nonpoor with regard to dietary intake of this nutrient is startling. The gap between these groups is highly significant

Fig. 4-2 Percent of Individuals Who Consumed Less Than 67% of the RDA for Calcium



for total races (P<.0001), whites (P<.001) and non-whites (P<.001). Almost one out of every two rural poor nonwhites consumed less than 67% of the RDA for iron. This contrasts with 32.7% of rural nonpoor nonwhites, and 36.3% of nonpoor nonwhites overall.

The highest rates ocurred among those rural poor nonwhites residing in the South, while Northeastern and Western whites appeared to be at least risk.

VITAMIN C

TOTAL RACES

43.2% of the total rural poor population consumed below 67% of the RDA for Vitamin C, compared to 31.1% of the rural nonpoor population and 29.1% of the U.S. nonpoor population. The differences between the rural poor and those with adequate income are significant (p<.0001). (Refer to Fig. 4-4, Table 4-1, 4-2).

WHITES

42.6% of the rural poor whites consumed below 67% of the RDA for Vitamin C, compared to 31.2% of the rural nonpoor white population and 29.0% of the total U.S. nonpoor white population.

Nonwhite

45.3% of the nonwhite rural poor population consumed below 67% of the RDA for Vitamin C. This compared to 28.9% of the rural nonpoor, nonwhite population and 29.9% of the total U.S. nonpoor, nonwhite population.

DISCUSSION

These data reveal that inadequate consumption of Vitamin C by the rural poor is highly prevalent. This finding carries particular urgency in light of recent reports by the National Academy of Sciences (39) and National Cancer Institute (40) of

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Fig. 4-3 Percent of Individuals Who Consumed Less Than 67% of the RDA for Iron

Rural Poor Vs. US Non-Poor

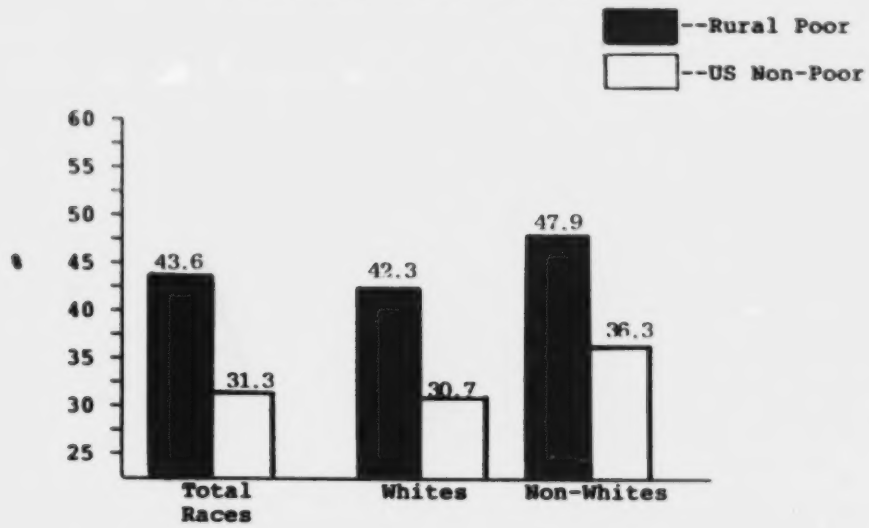
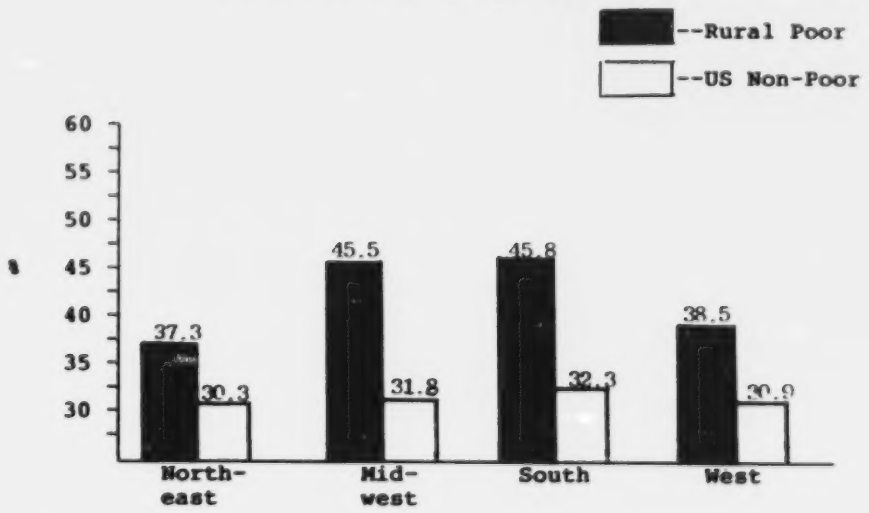


Fig. 4-3 Percent of Individuals Who Consumed Less Than 67% of the RDA for Iron

Rural Poor Vs. US Non-Poor



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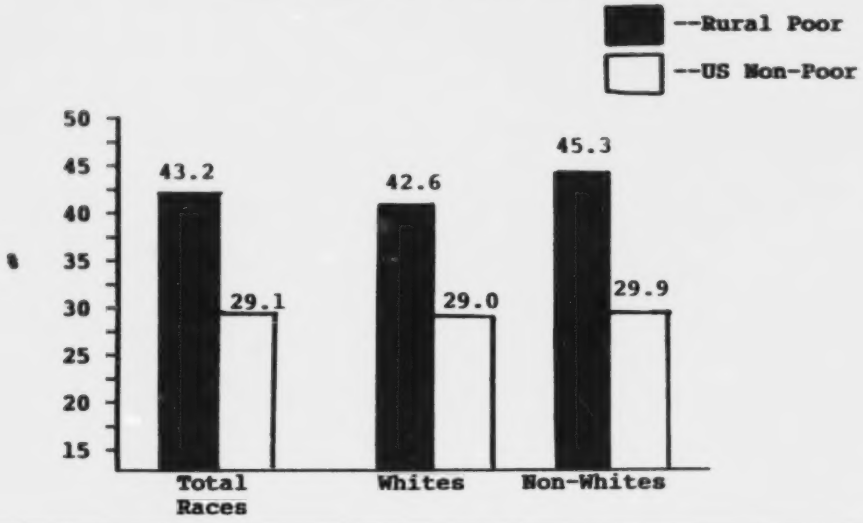
a negative correlation and presumably preventative effect of Vitamin C upon certain commonly diagnosed cancers.

The rural poor consumed less than the cutoff level of Vitamin C almost 50% more frequently than did the nonpoor population. Furthermore, the gap between the rural poor and nonpoor was highly significant (P<.001) in every region of the country except for the Northeast, where it reached the P<.005 level, indicating a widespread, national problem. Our findings are supported by those of other researchers (28) who, upon analyzing consumption data from USDA's Nationwide Food Consumption Survey (NFCS), found that nonmetro residents were less likely to consume 70% of the RDA for this nutrient than central city or suburban residents.

Regionally, the rural poor residing in the Northeast appeared to have less of a problem with regard to this nutrient.

Fig. 4-4 Percent of Individuals Who Consumed Less Than 67% of the RDA for Vitamin C



THIAMIN

Total Races

24.6% of the rural poor, 22.5% of rural nonpoor, and 23.0% of the U.S. nonpoor population consumed below 67% of the RDA for Thiamin. (Refer to Fig. 4-5 and Tables 4-1, 4-2).

White

23.7% of rural poor whites consumed below 67% of the RDA. This compares with 22.2% of the white rural nonpoor population, and 22.4% of the entire U.S. nonpoor white population.

Nonwhite

27.6% of the nonwhite rural poor population, 30.1% of the nonwhite rural nonpoor population, and 27.8% of entire nonwhite U.S. nonpoor population consumed below 67% of the RPA for this nutrient.

DISCUSSION

Unlike all other nutrients studied, thiamin

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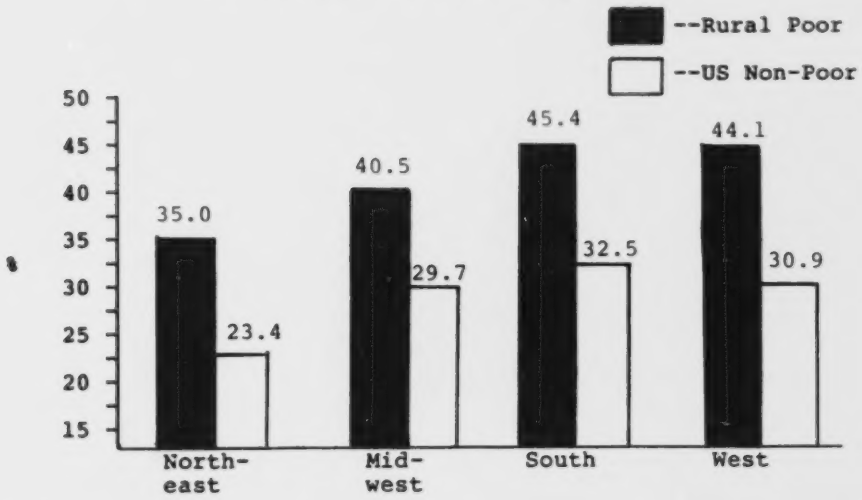
Fig. 4-4 Percent of Individuals Who Consumed Less Than 67% of the RDA for Vitamin C



consumption does not appear to be income-related. It is the only nutrient of those studied for which the rural poor did not have a significantly higher likelihood of inadequate intake. Only in the West did the magnitude of the disparity between the rural poor and nonpoor approach significance. Therefore, the rural poor do not appear to be at increased risk for developing a deficiency of this nutrient.

Our findings for this nutrient are consistent with our understanding of the dietary sources of thiamin. Data from USDA's NFCS Survey as well as that of NHANES I and II have shown that breads and cereals contribute the largest amounts of this nutrient to the U.S. diet (although meat foods provide the second largest source). Therefore, since these foods comprise a disproportionately large contribution to the diets of the poor (due to their relatively low cost), we would expect consumption of this nutrient to be relatively independent of income group.

Geographically, the Northeast once again had the lowest percentage of those failing to consume the standard for this nutrient.

NIACIN

TOTAL RACES

23.0% of the rural poor consumed below 67% of the RDA for niacin, compared to 14.6% of the rural nonpoor and 13.9% of the total U.S. nonpoor population. The differences between the rural poor and those with adequate income are significant ($p<.0001$) (Refer to Fig. 4-6, Tables 4-1 and 4-2).

White

21.6% of the white rural poor population consumed below 67% of the RDA for this nutrient. This compares to 14.5% of the rural nonpoor whites and 13.4% of the total

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U.S. nonpoor white population who consumed less than 67% of the RDA.

Nonwhite

27.9% of the rural poor nonwhite population consumed below 67% of the RDA for niacin,

Fig. 4-5 Percent of Individuals Who Consumed Less Than 67% of the RDA for Thiamin

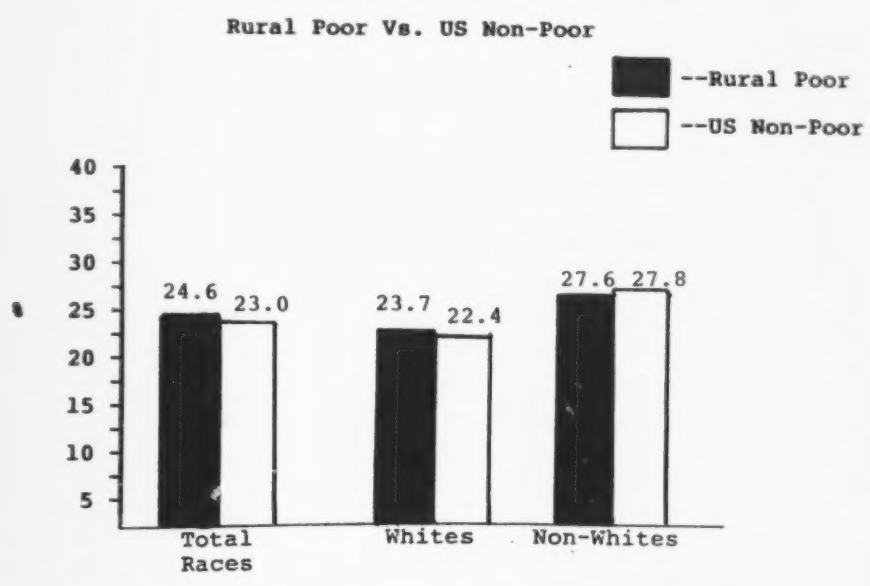
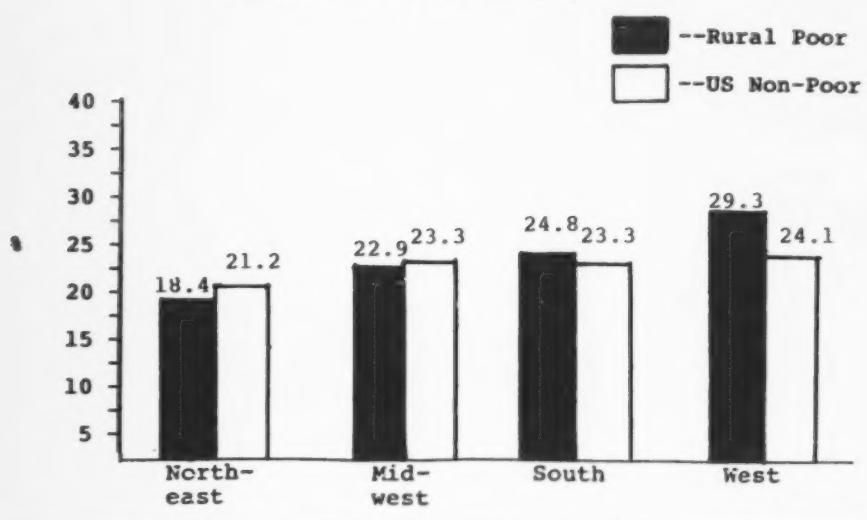


Fig. -- Percent of Individuals Who Consumed Less Than 67% of the RDA for Thiamin



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compared to 17.3% of the nonwhite rural nonpoor population and 17.6% of the total U.S. nonpoor, nonwhite population.

DISCUSSION

The prevalence of inadequate niacin consumption qualifies it as a moderately problematic nutrient among this population. However, because of the unusually large gap between the nonpoor and the rural poor with regard to consumption of this nutrient (the rural poor are 65% more likely to consume below 2/3 of the RDA than are the nonpoor), and because of the consistency of this gap across all regions of the nation, adequate status for this nutrient among the rural poor is of special concern.

RIBOFLAVIN

Total Races

22.5% of the rural poor consumed less than 67% of the RDA for riboflavin. This compares with 16.3% of the rural nonpoor population and 16.4% of the U.S. total nonpoor population. The differences between the rural poor and those with adequate income are significant ($p<.0001$). (Refer to Fig 4-7 and Tables 4-1, 4-2).

White

20.9% of the rural poor whites consumed below 67% of the RDA for riboflavin. This compares with 16.2% of the rural nonpoor whites and 15.5% of the entire U.S. nonpoor population.

Nonwhite

28.0% of rural poor nonwhites consumed below 67% of the RDA for riboflavin. This compares with 19.5% of the rural nonpoor, nonwhite population. and 23.0% of the total U.S. nonpoor, nonwhite population.

DISCUSSION

Inadequate consumption of riboflavin by the rural poor does not appear to be a major problem in the U.S. However, as a whole the rural poor are approximately 37% less likely to consume two-thirds of the RDA for this nutrient than the U.S. nonpoor population.

Rural poor nonwhites are considerably less likely to consume adequate levels of this nutrient than are rural poor whites (28% below versus 20.9%). They are also far less likely to meet their requirements than are rural nonpoor nonwhites (28% below versus 19.5%).

Regionally, the rural poor living in the Northeast appear to experience the least problem, while Southern rural poor nonwhites have the highest prevalence of inadequate intake.

PHOSPHORUS

RESULTS

TOTAL RACES

16.2% of the rural poor failed to consume 67% of the RDA for this nutrient. This compares to 10.7% of the rural nonpoor population and 9.4% of the entire U.S. nonpoor population. The differences between the rural poor and those with adequate income are highly significant ($p<.0001$). (Refer to Fig. 4-8 and Tables 4-1, 4-2)

White

15.2% of rural poor whites consumed less than 67% of the RDA, while 9.8% of the nonpoor whites and only 8.8% of the U.S. nonpoor white population failed to.

Nonwhite

19.7% of the rural poor non white population consumed less than 67% of the RDA for phosphorus. This compares with 14.9% of rural nonpoor nonwhites and 13.8% of U.S. nonpoor nonwhites who failed to consume that level.

DISCUSSION

Phosphorus does not appear to be a major

nutritional problem among the rural poor. While the prevalence of inadequate phosphorus consumption is significantly higher among the rural poor than the U.S. nonpoor

Fig. 4-6 Percent of Individuals Who Consumed Less Than 67% of the RDA for Niacin

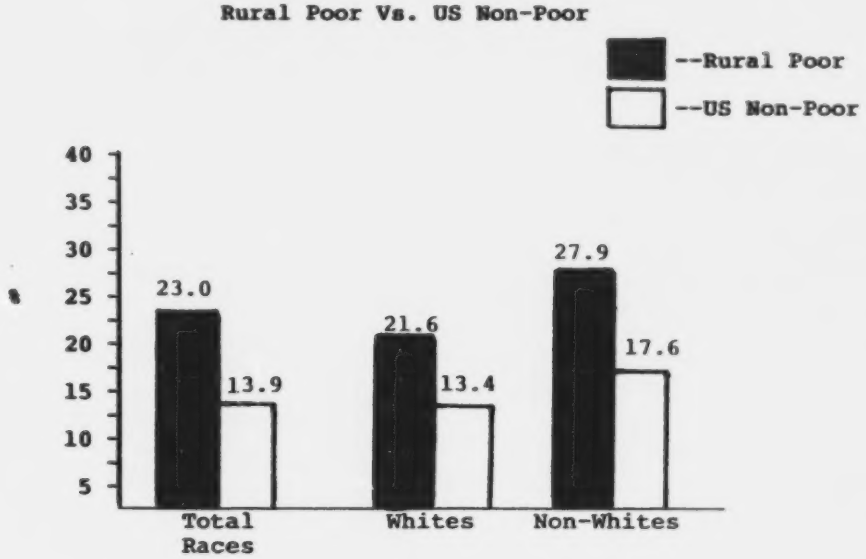
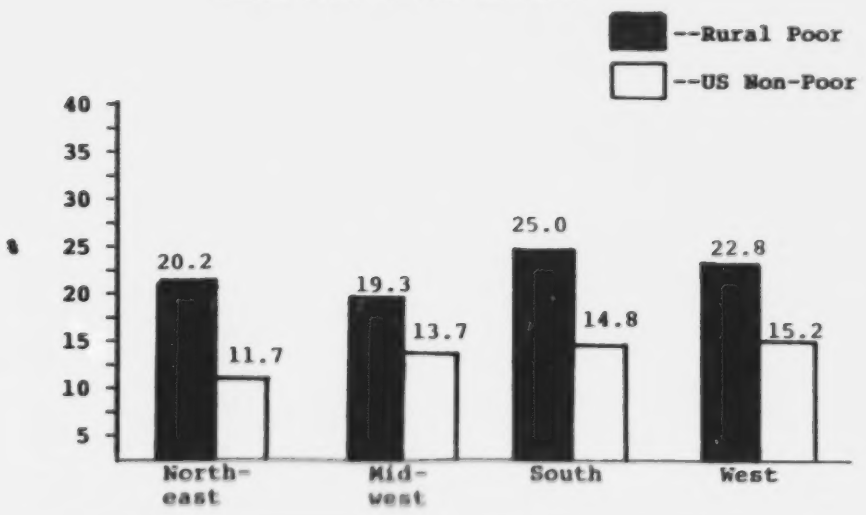


Fig. 4-6 Percent of Individuals Who Consumed Less Than 67% of the RDA for Niacin



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population, (P<.0001) the actual frequency is lower than for most nutrients studied. It is worth noting, however, that rural poor nonwhites were significantly more likely to consume less than the cutoff level than were rural poor whites. Once again, the rural poor living in the Northeast faired better than those in the rest of

Fig. 4-7 Percent of Individuals Who Consumed Less Than 67% of the RDA for Riboflavin

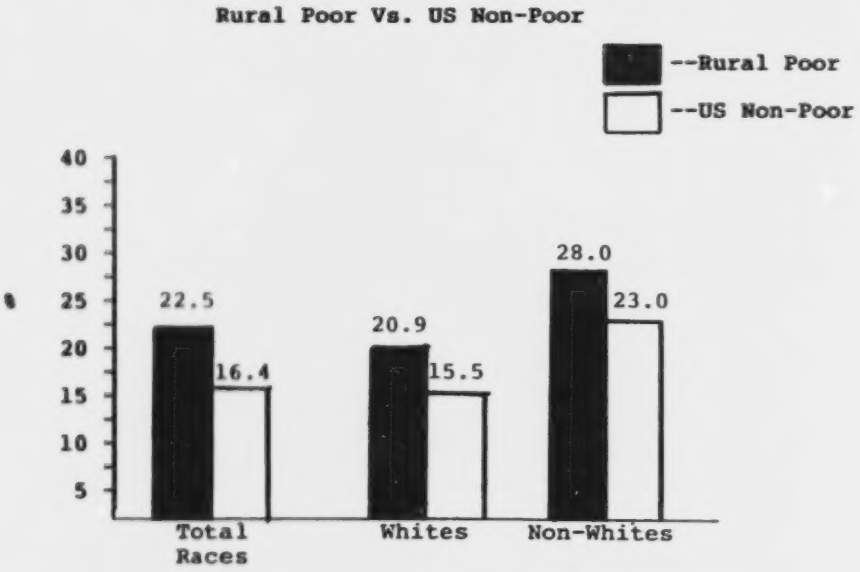
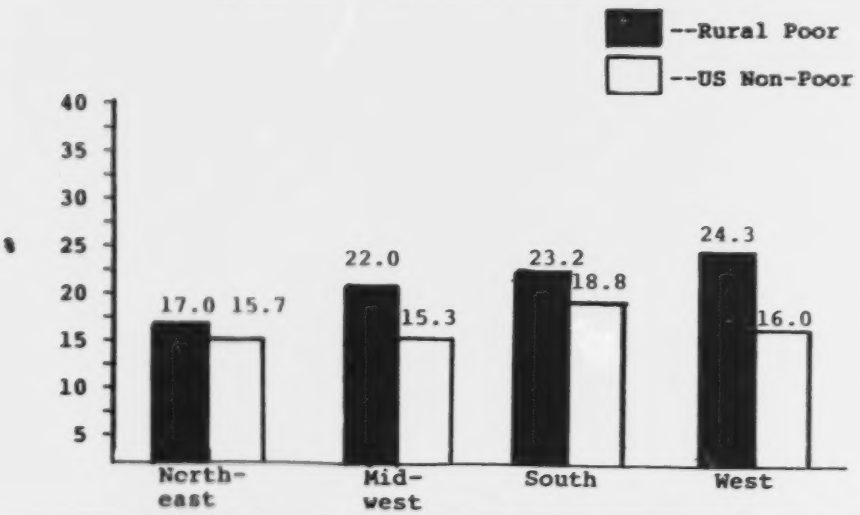


Fig. 4-7 Percent of Individuals Who Consumed Less Than 67% of the RDA for Riboflavin



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the nation.

PROTEIN

Total Races

12.3% of the rural poor consumed less than 67% of the RDA for protein. This compares with 6.7% of rural nonpoor and 6.2% of the U.S. nonpoor population. The differences between the rural poor and those with adequate income are significant ($p<.001$) (Refer to Fig 4-9 and Tables 4-1 and 4-2).

White

While 12.6% of rural poor whites consumed less than 67% of the RDA for this nutrient

Fig. 4-8 Percent of Individuals Who Consumed Less Than 67% of the RDA for Phosphorus Rural Poor Vs. US Non-Poor

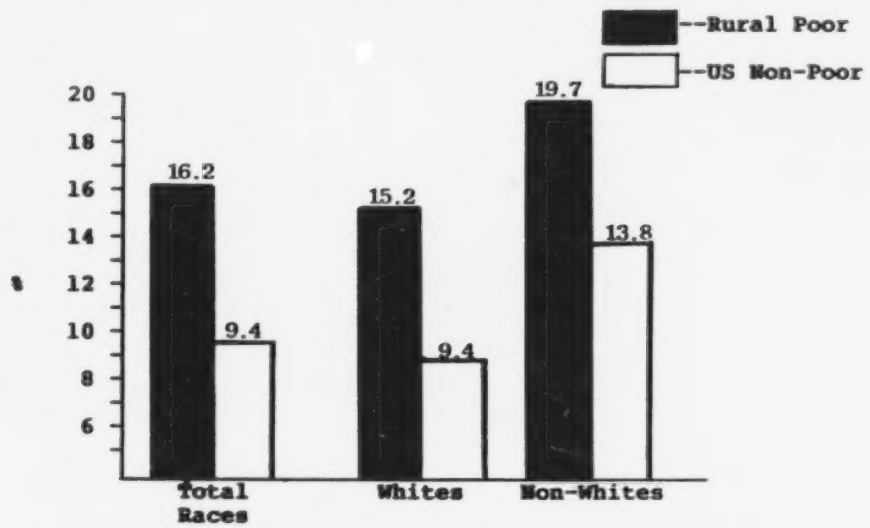

Fig. 4-8 Percent of Individuals Who Consumed Less Than 67% of the RDA for Phosphorus Rural Poor Vs. US Non-Poor

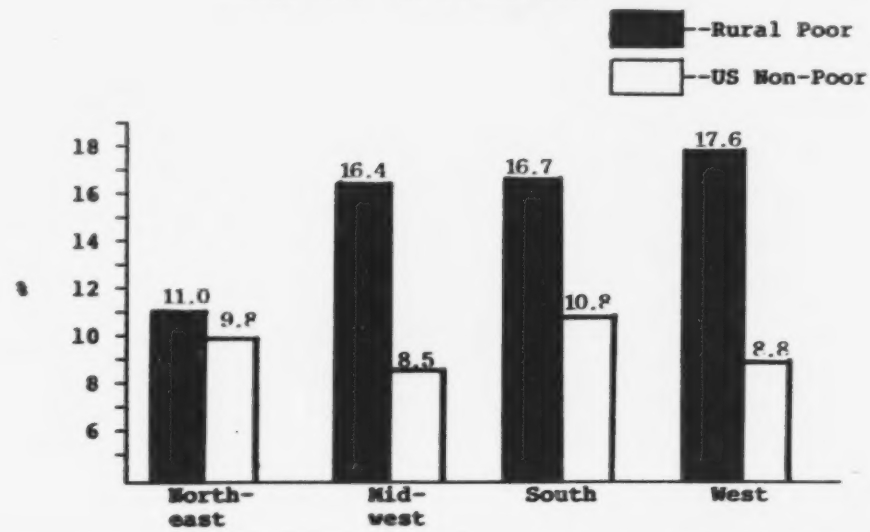

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Fig. 4-9 Percent of Individuals Who Consumed Less Than 67% of the RDA for Protein

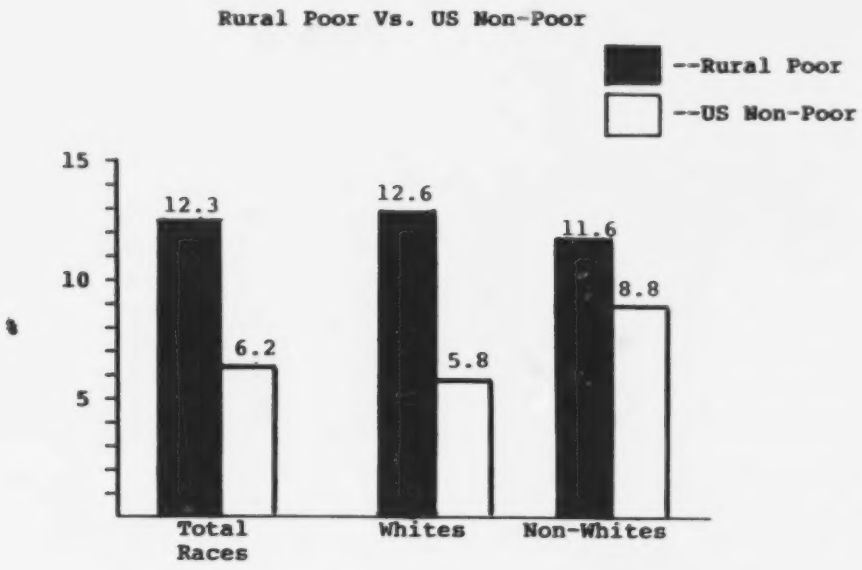

Fig. 4-9 Percent of Individuals Who Consumed Less Than 67% of the RDA for Protein

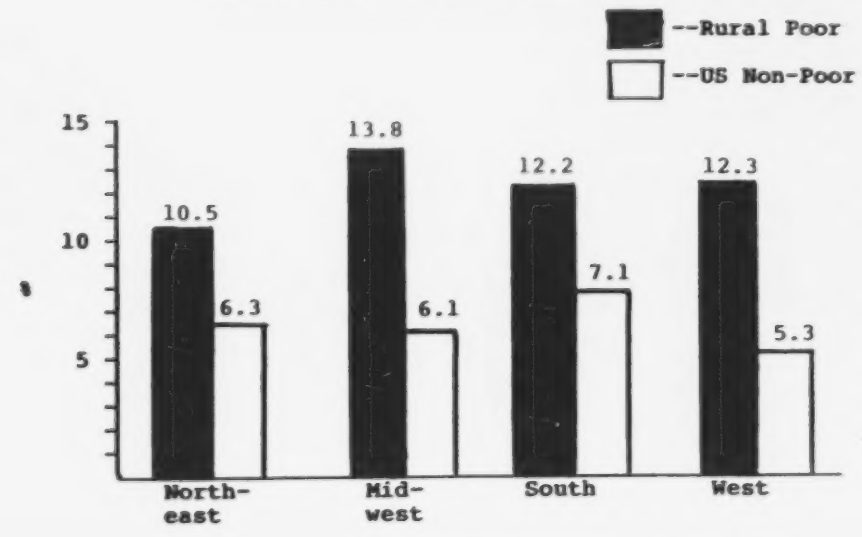

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TABLE 4-2

PERCENT OF INDIVIDUALS WHO CONSUMED LESS THAN 67 PERCENT OF THE RDA FOR NINE NUTRIENTS EXAMINED: RURAL POOR VS. RURAL NONPOOR

	NUMBERS SAMPLED[3]		PROTEIN		CALCIUM		VITAMIN A		IRON		THIAMIN		RIBOFLAVIN		NIACIN		VITAMIN C		PHOSPHORUS	
ALL REGIONS	RP[1]	RNP[2]	RP	RNP	RP	RNP	RP	RNP	RP	RNP	RP	RNP	RP	RNP	RP	RNP	RP	RNP	RP	RNP
TOTAL	1252	3701	12.3 **	6.7	43.6 *	39.6	48.0	**41.6	43.6	**32.2	24.6	22.5	22.5	**16.3	23.0	**14.6	43.2	**31.1	16.2	**10.7
WHITE	964	3557	12.6 **	6.7	40.0	39.8	49.0	**41.6	42.3	**32.1	23.7	22.2	20.9	*16.2	21.6	**14.5	42.6	**31.2	15.2	** 9.8
NONWHITE	288	144	11.6	8.4	55.5	49.0	44.7	40.5	47.9	*32.7	27.6	30.1	28.0	*19.5	27.9	*17.3	45.3	*28.9	19.7	14.9
NORTHEAST																				
TOTAL	123	690	10.5	7.7	34.3	39.4	35.6	32.6	37.3	34.9	18.4	20.7	17.0	13.7	20.2	12.1	35.0	22.9	11.0	12.2
WHITE	110	663	11.5	8.0	33.6	40.1	37.2	33.1	37.9	35.1	17.7	20.3	15.8	13.8	19.3	12.3	32.9	23.1	12.0	12.2
NONWHITE	13	28	2.7	1.2	39.7	24.3	22.6	20.1	32.7	30.5	24.1	31.3	26.8	13.1	27.6	6.9	52.6	16.4	2.7	12.7
MIDWEST																				
TOTAL	246	804	13.8	6.3	42.6	38.5	45.9	41.9	45.5	29.9	22.9	22.6	22.0	16.2	19.3	14.9	40.5	31.5	16.4	9.0
WHITE	209	792	15.4	6.3	41.3	38.4	45.4	41.8	45.4	30.1	23.4	22.7	21.7	16.3	18.1	14.9	38.0	31.5	17.1	8.8
NONWHITE	38	12	5.2	8.7	49.7	40.9	48.7	54.7	46.0	15.3	20.0	22.3	23.3	8.7	25.6	15.3	54.5	29.9	13.1	22.6
SOUTH																				
TOTAL	663	1471	12.2	7.1	43.0	43.3	49.6	47.1	45.8	32.3	24.8	23.2	21.2	18.8	25.0	14.1	45.4	35.0	16.7	9.9
WHITE	495	1394	12.2	7.1	39.0	42.4	52.2	47.2	43.9	32.0	23.7	22.6	21.2	18.5	24.0	13.8	46.3	35.1	14.8	9.7
NONWHITE	167	77	12.0	8.0	55.1	60.3	41.9	44.8	51.4	38.6	28.3	33.0	29.1	23.3	27.9	19.3	43.0	33.1	22.3	13.6
WEST																				
TOTAL	220	736	12.3	5.5	51.7	33.8	52.4	38.8	38.5	31.8	29.3	22.7	24.3	13.8	22.8	17.8	44.1	30.4	17.6	9.3
WHITE	150	708	10.6	5.1	46.6	33.3	52.0	38.6	36.3	32.0	28.6	22.6	22.5	13.6	19.8	17.6	43.9	30.5	16.3	9.0
NONWHITE	70	28	15.8	16.8	62.6	45.5	53.2	42.8	43.2	25.6	30.7	24.3	28.3	20.1	29.3	22.7	44.7	29.2	20.3	17.3

Source: NHANES II

1 Rural Poor
2 Rural Nonpoor
3 Sample weights have been applied to these data. Therefore, data for "All Regions" are representative of the entire non-institutionalized U.S. population for ages sampled. Data presented by racial or geographic category are also representative within the respective category for the ages sampled.

* The difference between the rural poor and the nonpoor is significant at the .05 level.
** The difference between the rural poor and the nonpoor is significant at the .001 level.
Tests for significance were conducted only for "All Regions".

TABLE 4-1

PERCENT OF INDIVIDUALS WHO CONSUMED LESS THAN 67 PERCENT OF THE RDA FOR NINE NUTRIENTS EXAMINED: RURAL POOR VS. U.S. NONPOOR

	NUMBERS SAMPLED[3]		PROTEIN		CALCIUM		VITAMIN A		IRON		THIAMIN		RIBOFLAVIN		NIACIN		VITAMIN C		PHOSPHORUS	
ALL REGIONS	RP[1]	USNP[2]	RP	USNP	RP	USNP	RP	USNP	RP	USNP	RP	USNP	RP	USNP	RP	USNP	RP	USNP	RP	USNP
TOTAL	1252	11538	12.3 **	6.2	43.6 **	38.1	48.0 **	38.7	43.6 **	31.3	24.6	23.0	22.5 **	16.4	23.0 **	13.9	43.2 **	29.1	16.2 **	9.4
WHITE	964	10212	12.6 **	5.8	40.0 *	36.5	49.0 **	38.3	42.3 **	30.7	23.7	22.4	20.9 **	15.5	21.6 **	13.4	42.6 **	29.0	15.2 **	8.8
NONWHITE	288	1326	11.6	8.8	55.5	50.2	44.7	42.2	47.9 **	36.3	27.6	27.8	28.9	23.0	27.9 **	17.6	45.3 **	29.9	19.7 *	13.8
NORTHEAST																				
TOTAL	123	2800	10.5	6.3	34.3	38.6	35.6	34.3	37.3	30.3	18.4	21.2	17.0	15.7	20.2	11.7	35.0	23.4	11.0	9.8
WHITE	110	2558	11.5	6.2	33.6	37.5	37.2	34.4	37.9	29.8	17.7	20.5	15.8	14.9	19.3	11.2	32.9	23.6	12.0	9.2
NONWHITE	13	242	2.7	7.4	39.7	51.0	22.6	33.5	32.7	35.4	24.1	28.9	26.8	24.3	27.6	17.2	52.6	21.1	2.7	16.7
MIDWEST																				
TOTAL	246	3076	13.8	6.1	42.6	34.3	45.9	37.0	45.5	31.8	22.9	23.3	22.0	15.3	19.3	13.7	40.5	29.7	16.4	8.5
WHITE	209	2837	15.4	5.6	41.3	33.1	45.4	36.6	45.4	31.4	23.4	22.7	21.7	14.8	18.1	13.2	38.0	29.3	17.1	7.9
NONWHITE	38	239	5.2	11.6	49.7	47.5	48.7	42.7	46.0	36.5	20.0	30.1	23.3	22.2	25.6	19.7	54.5	33.8	13.1	15.7
SOUTH																				
TOTAL	663	2546	12.2	7.1	43.0	43.1	49.6	45.0	45.8	32.3	24.8	23.3	23.2	18.8	25.0	14.8	45.4	32.5	16.7	10.8
WHITE	495	2215	12.2	6.9	39.0	41.6	52.2	45.1	43.9	31.3	23.7	22.1	21.2	17.8	24.0	14.2	46.3	32.7	14.8	10.4
NONWHITE	167	330	12.0	8.4	55.1	53.2	41.9	44.2	51.4	39.0	28.3	31.2	29.1	25.7	27.9	18.5	43.0	31.1	23.3	13.7
WEST																				
TOTAL	220	3116	12.3	5.3	51.7	37.3	52.4	39.2	38.5	30.9	29.3	24.1	24.3	16.0	22.8	15.2	44.1	30.9	17.6	8.8
WHITE	150	2602	10.6	4.7	46.6	35.0	52.0	38.1	36.3	30.2	28.6	24.2	22.5	15.0	19.8	15.0	43.9	30.7	16.3	8.2
NONWHITE	70	515	15.8	8.4	62.6	49.2	53.2	44.9	43.2	34.9	30.7	23.9	28.3	21.1	29.3	16.1	44.7	31.5	20.3	11.8

Source: NHANES II

1 Rural Poor
2 U.S. Nonpoor
3 Sample weights have been applied to these data. Therefore, data for "All Regions" are representative of the entire non-institutionalized U.S. population for ages sampled. Data presented by racial or geographic category are also representative within the respective category for the ages sampled.

* The difference between the rural poor and the nonpoor is significant at the .05 level.
** The difference between the rural poor and the nonpoor is significant at the .001 level.
Tests for significance were conducted only for "All Regions".

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only 6.7% of the rural nonpoor white population and 5.8% of the U.S. nonpoor white population consumed inadequate levels.

Nonwhite

11.6% of rural poor nonwhites consumed less than 67% of the RDA, compared to 8.4% of the rural nonpoor nonwhite population and 8.8% of the U.S. nonpoor nonwhite population.

DISCUSSION

These data suggest that overall, consumption of adequate protein is not a major problem for the rural poor. However, we note that the rural poor were approximately twice as likely to consume less than two-thirds of the RDA for this nutrient. It should also be noted that protein is one of the few essential nutrients for which the frequency of deficiency was lower among rural poor nonwhites than among rural poor whites. Also, with the exception of a somewhat lower deficiency rate among the rural poor of the Northeast, consumption of protein appears relatively uniform throughout the nation.

Summary Analyses

An additional analysis conducted to help summarize our findings involved the tabulation of the percentage within each economic group who failed to consume 67% of the RDA for at least five of the nutrients analyzed in this study. (Figure 4-10).

These summary data demonstrate that the rural poor were more than 65% more likely to consume diets which are inadequate for multiple essential nutrients. That almost one out of three rural poor non whites, and slightly less than one out of four rural poor whites fell into this critically high risk group, is of serious concern.

Similarly tabulated and compared were the percentages of individuals who failed to meet 67% of the RDA for at least seven of the nine nutrients considered. (Table 4-11).

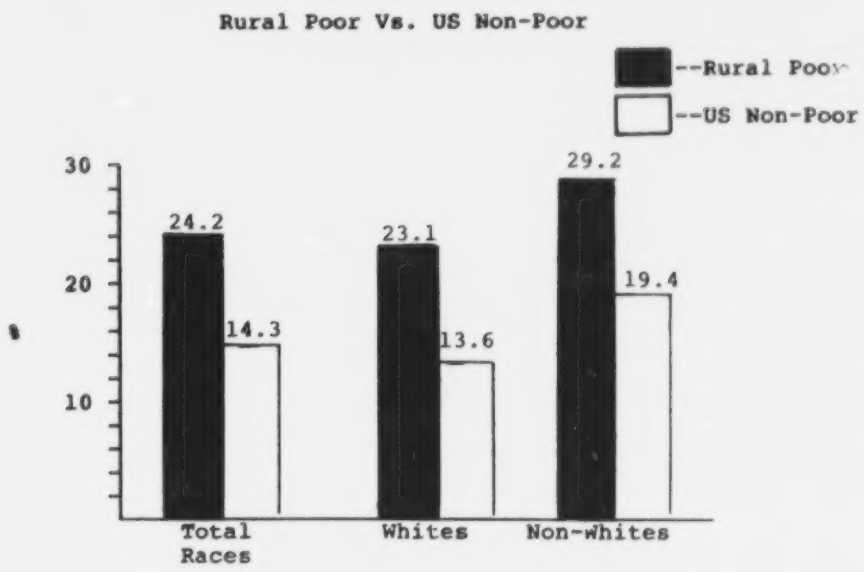
These analyses demonstrate that the rural poor were more than twice as likely as were the U.S. nonpoor to experience this severe level of dietary inadequacy (11.6% vs 5.6%). Moreover, 16% of rural poor non whites fell into this high risk group.

Based upon the nine nutrients examined, our analyses also revealed that Western and Southern rural poor residents consumed diets with the lowest quantities of essential nutrients. This was true for both whites and non whites. The Midwestern rural poor faired somewhat better, while those residing in the Northeast had consistantly lower prevalences of nutritional deprivation.

Interpretation

Analyses of NHANES II dietary data have revealed a surprisingly consistent picture of severe nutritional inadequacy and heightened risk of deficiency experienced by the rural poor. Some nutrients were found to be particularly problematic. For example, the proportion of rural poor who consumed less than adequate amounts of vitamin C greatly exceeded that proportion of the nonpoor. For other nutrients, however, although the proportion of rural poor who consumed below the cutoff was high, the gap between the two groups was less significant. Calcium is the best example of such a nutrient. For other nutrients such as niacin, while the magnitude of the disparity between the rural poor and the nonpoor was large, the absolute proportion of those who consumed inadequate levels was lower.

Fig. 4-10 Percent of Individuals Consuming Less Than 67% of the RDA for At Least Five Nutrients Studied



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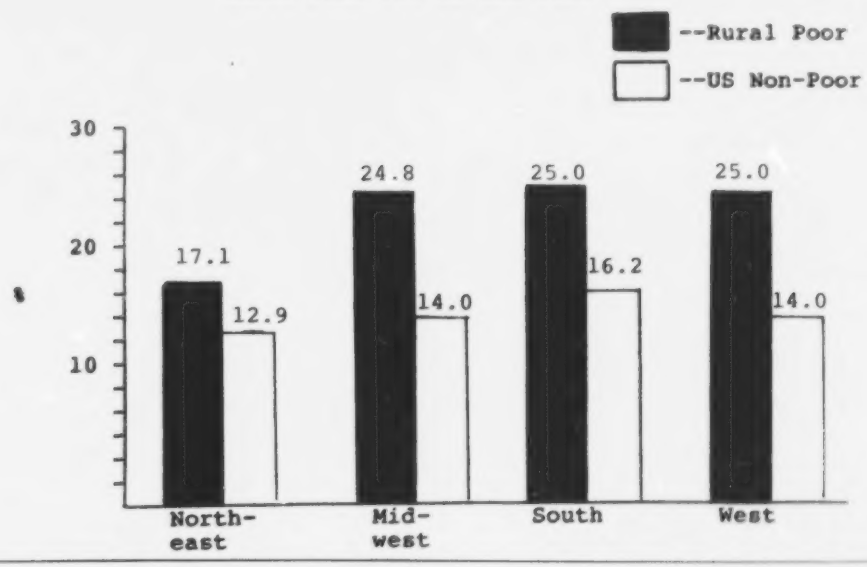

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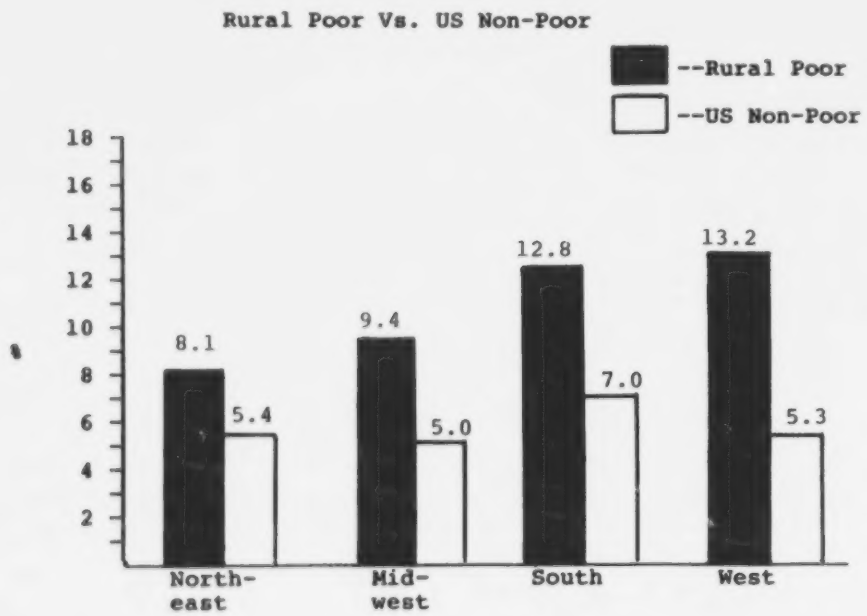
Fig. 4-11 Individuals Consuming Less Than 67% of the RDA for At Least Seven Nutrients Studied



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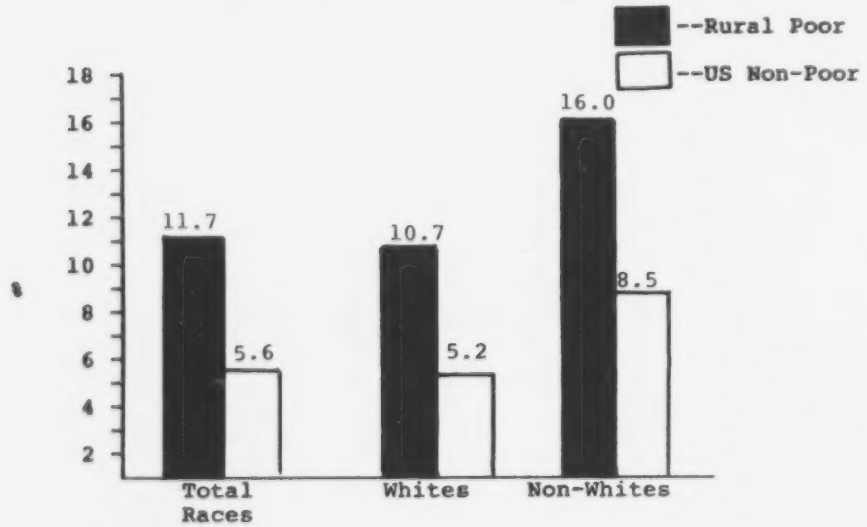

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Geographic Profile of Dietary Intake

While the rural poor in each region of the U.S. exhibited higher frequencies of inadequate nutrient intake overall than did the nonpoor, several region-specific patterns were observed. Recognition of these regional differences can be extremely helpful toward developing a better understanding of the specific nutritional problems and potential health problems faced by the rural poor in each part of the nation. The following section will highlight the major variations in nutrient intake and dietary inadequacy which exist among the rural poor in each of the four regional areas studied.

Northeast

From our summary data it is apparent that those rural poor residing in the Northeast consumed the most adequate diets overall The Northeast reported the lowest proportion of inadequate intakes for each of the nutrients studied except niacin, for which it was a close second.

When the proportion of the Northeastern rural poor who consumed below the 67% level for at least five of the nine nutrients studied is compared to the percentage in the other regions, we see that the Northeastern rural poor fall into this category significantly less frequently than the rural poor in any of the other regions (17.1% vs 24.8%-25.0%). (See Table 4-10). When the same comparison is applied to those consuming below the 67% level for at least seven nutrients, the Northeast again faired the best (8.1% vs 9.4% - 13.2%). Nevertheless, the percent who fell into this category was still considerably higher among the rural poor than among the nonpoor in the Northeast (5.4%).

Midwest

The Midwestern rural poor diet appears to be considerably less adequate than that of the Northeastern rural poor, and somewhat more adequate than that of the rural poor in he South and West.

Comparing the proportion of Midwestern rural poor residents who consumed below the 67% cutoff for five or more nutrients with that proportion in the other regions, we found that the 24.8% in the Midwest who met this criteria significantly exceeded the level who did so in the Northeast (17.1%), but approximately equaled those of the South and West (25.0%). When the same comparison is carried out for seven or more of the nine nutrients studied, we find that the Midwest was intermediate among the four regions (9.4% vs 8.1%-13.2%) (see Table 4-11).

South

For most nutrients studied, the rural poor residing in the South consumed diets which were either the poorest quality or the second poorest quality (after the West) of the regions studied. (See Tables 4-11 and 4-12).

As can be seen in table 11, 25% of Southern rural poor residents fell below the 67% level for five or more of the nine nutrients studied. When the percentage who consumed less than 67% of the RDA for seven or more of the nine nutrients was analyzed (Table 12), we found that 12.8% of the Southern rural poor were included--more than one out of every eight persons.

West

Along with those in the South, a large proportion of rural poor residing in the West consumed diets which were grossly inadequate for virtually every nutrient

observed. Furthermore, adequate consumption of Vitamin A, Calcium, and Vitamin C were particular problems in this region (52.4%, 51.7%, and 44.1% respectively failed to consume the 67% level).

Also similar to those in the South, one out of four rural poor residents in this region consumed below 67% of the RDA for at least five of the nine nutrients studied. Even more striking - 13.2% fell below that level for at least seven of the nine nutrients studied. (This compares to 5.3% of the nonpoor in this region).

Racial Differences in Consumption

In general, substantially more rural poor nonwhites than rural poor whites consumed inadequate diets. Exceptions to this racial disparity included protein and vitamin A, for which rural poor nonwhites had a slightly lower prevalence of inadequate intakes.

Table 4-10 shows that 29.2% of nonwhite rural poor residents, compared to 23.1% of rural poor white residents failed to consume the cutoff level for at least 5 of the 9 nutrients studied. When at least seven nutrients below the cutoff are considered, the rates were 16.0% among rural poor nonwhites and 10.7% among rural poor whites--a disparity of approximately 50 percent

Also worth noting is the higher prevalence of inadequate consumption by nonwhites of calcium, (55.5% vs 40.0%) iron, (47.9% vs 42.3%) and vitamin C (45.3% vs 42.6%).

Comparative Data

The results contained in this study are consistent with those of the USDA's Nationwide Food Consumption Survey Supplement of Low Income Households, 1977-1978 (20). The analyses carried out by USDA, provide comparative information on the diets of the rural poor relative to the suburban and central city poor*. These data are presented in Table 4-3.

These data indicate that, as a percentage of the RDA, mean intakes were lowest among the nonmetropolitan poor for 11 of 13 nutritents measured. Only for iron and phosphorus were reported intakes higher among the nonmetropolitan poor, and only by a small margin. Furthermore, rural poor infants and children consumed lower percentages of the RDA for iron than their central city or suburban counterparts. This was true for both males and females up to five years of age, those most vulnerable to the detrimental social and cognitive effects of iron deficiency.

Most striking among the NFCS data were the large disparities with regard to consumption of vitamin A and vitamin C. These data indicate that, with the exception of infants less than one year of age, vitamin A consumption by nonmetropolitan poor children was 30-60% lower than that of the metropolitan poor. When all age groups are considered, the rural poor consumed over 25% less of this vitamin than the central city poor. Even greater disparities were recorded for vitamin C consumption with the age-specific patterns similar to those of vitamin A. Combining all age groups, the rural poor reported consuming over 30% less of this nutrient than the central city poor. Furthermore, while two age-sex groups among the central city poor reported intakes below the RDA for this nutrient, there were nine such groups among the non metropolitan poor.

Another nutrient identified as a problem among the rural poor by the USDA study was

* USDA defined poor persons as those participating or eligible to participate in the Food Stamp Program.

vitamin B6 (pyridoxine). The poor in general reported the lowest levels of consumption for this nutrient (69% of the RDA among the non metro poor, and 73% among the central city poor.) Although the difference between these groups is relatively insignificant compared to that of the nutrients previously discussed, the extremely low intakes reported by the poor overall merit our attention. Deficiencies of this nutrient have been reported to result in premature births, and subsequent low birthweight births and renal tube defects in infants (43).

Conclusion

The rural poor throughout the nation consumed diets which were grossly inadequate. The extent of the problem is best seen when contrasted with the diet of the nonpoor U.S. population. For many of the nutrients studied, the rural poor were 75 percent more likely not to meet standards of adequate intake than were the nonpoor. In some cases, the disparity exceeded 100%.

As would be expected, of the nine nutrients studied, calcium, iron, vitamin A, and vitamin C posed the major problems among the rural poor in each region of the country. Although the consumption of adequate levels of these nutrients is less than optimal for the nonpoor population as well, it is significantly worse for the rural poor.

With the exception of thiamin, the rural poor failed to consume 67% of the RDA significantly more frequently than did the nonpoor for each of the nutrients studied.

A great deal of regional diversity in consumption was observed. The Northeast was the region in which the rural poor consumed the highest quality diets. For eight of the nine nutrients studied, the rural poor residing in the Northeast had the lowest prevalence of inadequate intake. On the other hand, the rural poor of the South and West consumed the least adequate diets, while the Midwestern rural poor had diets which were intermediate in adequacy.

In addition, rural poor nonwhites failed to consume adequate diets significantly more often than did rural poor whites. With the exception of vitamin A and protein, rural poor whites were more likely to consume adequate levels of the nutrients studied than were rural poor non whites.

These results were further supported by similar findings from the USDA's NFCS study, which found that intake of 11 of the 13 nutrients studied were lower among the rural poor than among the central city or suburban poor.

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TABLE 4-3

NUTRITIVE VALUE OF FOOD AS A PERCENTAGE OF 1980 RECOMMENDED DIETARY ALLOWANCES IN A 1 DAY PERIOD 1977-1978[1]

SEX AND AGE (YEARS)	INDIVIDUALS (NUMBER)			IRON			PHOSPHORUS			VITAMIN A VALUE			VITAMIN B6			VITAMIN C		
	central city	suburban	nonmetropolitan	central city	suburban	nonmetropolitan	central city	suburban	nonmetropolitan	central city	suburban	nonmetropolitan	central city	suburban	nonmetropolitan	central city	suburban	nonmetropolitan
MALES AND FEMALES:																		
UNDER 1	83[2]	90[2]	63[2]	188	165	160	210	168	204	282	155	223	147	162	131	255	166	216
1-2	240[2]	156[2]	143[2]	64	63	51	134	140	120	154	212	143	129	147	105	149	164	133
3-5	354	310	231	80	79	74	124	115	111	167	161	128	96	97	83	166	179	132
6-8	302	288	234	110	102	105	141	136	137	203	176	121	88	90	82	198	192	145
MALES:																		
9-11	234	117	130	94	90	96	129	133	129	133	122	106	85	88	83	177	213	172
12-14	173	129	156	76	75	75	104	117	114	92	117	84	83	89	83	185	145	122
15-18	269	171	135	84	72	82	120	114	116	101	74	108	79	69	81	155	102	107
19-22	129	128	81	136	134	156	137	143	197	83	130	78	66	57	83	204	141	138
23-34	280	224	200	136	160	157	164	178	180	89	86	103	68	78	78	126	88	137
35-50	199	202	172	153	150	155	152	153	166	100	95	115	67	66	68	138	126	88
51-64	114	122	131	133	133	137	161	132	143	111	99	80	64	54	57	91	152	78
65-74	59	85	103	137	117	140	142	131	155	144	89	130	58	56	62	134	123	96
75 AND OVER	54	57	59	95	136	116	107	154	127	75	59	127	40	48	54	70	54	80
FEMALES:																		
9-11	169	107	105	85	81	87	124	116	117	125	93	121	75	74	70	162	179	137
12-14	342	88	138	63	66	67	110	100	93	113	95	105	69	75	73	183	145	146
15-18	256	147	153	56	54	56	80	88	80	99	66	88	51	49	51	131	135	90
19-22	227	200	104	62	64	58	124	125	116	98	97	82	59	61	55	149	126	87
23-34	472	304	319	65	51	57	124	103	113	144	66	98	61	50	54	133	96	87
35-50	419	269	270	55	51	59	101	106	108	124	71	92	49	47	51	136	95	82
51-64	285	199	217	115	108	104	120	103	111	174	156	132	63	54	52	157	109	102
65-74	137	226	153	111	88	102	111	104	111	349	117	153	54	46	50	102	109	121
75 AND OVER	112	110	105	114	86	97	126	97	107	320	100	148	56	45	52	186	98	98
ALL INDIVIDUALS	4809[2]	3729[2]	3405[2]	90	92	94	125	123	126	142	113	113	73	72	69	155	133	114

Source: USDA, Survey of Food Consumption in Households 1977-78, November 1977-March 1978 (preliminary).

1 Based on 24-hour dietary recall of day preceding interview.
2 Excludes breast-fed infants.

Chapter 5

BIOCHEMICAL AND HEMATOLOGICAL INDICATORS

RESULTS OF NHANES II ANALYSES

Chapter 5

BIOCHEMICAL AND HEMATOLOGICAL INDICATORS

RESULTS OF NHANES II ANALYSES

PRESENTATION OF DATA FROM NHANES II

BIOCHEMICAL AND HEMATOLOGICAL LABORATORY TEST

Introduction

In this section, the results of analyses of biochemical and hematological data from NHANES II are presented. Included in these analyses are six biochemical tests which were used to measure the status of four nutrients: Vitamin A, Iron, Zinc, and Vitamin C.

Preceding the presentation of results for each nutrient, a brief narrative explains the physiological role of the nutrient, its reported prevalence of deficiency among the U.S. population, and limitations inherent in the laboratory method used to determine its status.

In addition, because of the critical role which iron plays in normal social and intellectual development during infancy and childhood, a somewhat more detailed discussion of its physiological significance is presented.

After presenting the results from each individual biochemical test studied, the data are compiled and summarized in Tables 5-1 and 5-2.

IRON

Existence of Deficiency

Iron deficiency anemia is considered the most common nutritional disorder throughout the world (34,42). Each of the major national surveys conducted in the U.S. which examined iron status (the Preschool Nutrition Survey, the Ten State Nutrition Survey, NHANES I and II and the CDC's Pediatric Nutrition Surveillance System) found iron deficiency anemia to be a problem among infants and young children. More recent studies show that up to 44% of U.S. children under 2 years of age are thought to suffer from some degree of iron deficiency (59).

Physiological Role and Impact of Deficiency

Iron deficiency anemia is usually caused by insufficient consumption of iron in the diet, excessive blood loss, or impaired absorption of iron. The resulting anemia is characterized by an abnormal physiologic state in which the level of hemoglobin, the primary oxygen transporting vehicle in the blood, drops below required levels. With insufficient hemoglobin available to transport oxygen from the lungs to the rest of the body, cells throughout the body lose their ability to efficiently metabolize energy nutrients. As the rate of energy mobilization declines, the resulting fatigue, weakness, and dizziness set in.

As anemia persists, a wide range of debilitating physical and psychological conditions ensue, including: decreased resistance to infections, impaired learning and cognitive development in children, and decreased work capacity and irritability (34,-55-57). These conditions are particularly detrimental to children whose normal development depends upon their ability to

keep up with their peers in the cognitive areas. Iron deficiency therefore reduces a child's ability to develop normally, and of reaching his/her potential (42).

Moreover, studies which controlled for socio-economic factors as well as for other nutrient deficiencies have confirmed that the cognitive impairments observed among iron deficient children resulted from iron deficiency, and were not mediated by confounding factors (57).

The detrimental effects of poor iron status during gestation on pregnancy outcome have also been demonstrated. In a study involving 59,391 pregnancies, Garn found that poor iron status (as indicated by low hemoglobin values) was related to increased low birthweight, prematurity, fetal death, and other birth abnormalities (58). Furthermore, low birthweight and premature infants generally have lower iron stores at birth, greatly increasing their risk of developing the deficiency during their first year of life (58).

Testifying on this topic before the House Select Committee on Hunger and the Subcommittee on Health and the Environment of the House Committee on Energy and Commerce, noted researcher, Dr. Earnesto Pollitt of the University of Texas School of Public Health, recently summarized the impact which this deficiency exacts upon young children:

> "Specifically, iron deficient infants obtain lower scores than iron replete subjects of the same age in scales of mental development. Intramuscular administration of age-appropriate dosages of iron to the iron deficient infants results in significant improvements in developmental scale scores. The initial differences between iron depleted and iron replete infants disappear after a therapeutic intervention. Among preschool children, iron deficiency has also been associated with deficits in attention and in learning new concepts in problem solving situations. In these cases -- as among infants -- the deficits in cognition disappear following controlled and age appropriate treatment with iron. School children with iron deficiency have also obtained lower educational achievement test scores than iron replete subjects. Following iron repletion their achievement scores increased significantly above those of iron deficient children treated with a placebo. Iron deficiency among nine-to-ten year old children has also been related to deficits in attention and in concentration; these deficits, however, dissapear following treatment. <u>The significance of these findings is obvious given that the scholastic progress of the iron deficient child is in jeopardy.</u>

The biological reasons for the cognitive deficits observed in the iron deficient subject are unknown. Iron is an important cofactor in various brain enzymes and iron depletion might thus result in alterations of brain neurochemistry. Alternatively, iron deficiency may have systemic effects which reduce the level of alertness of the organism and therefore may have an adverse

influence on attention. In conclusion, although there is still much to learn about the functional consequences of iron deficiency the available evidence clearly shows that iron deficiency is detrimental to a child's intellectual development." (57)

Iron Stores and Homeostasis

Iron is found in the blood, but it is stored in the liver, spleen, and bone marrow. Adequate stores play a crucial role in an individual's health. This is because iron needs are increased during specific "high demand" periods. These include times of growth, as well as following blood loss or other physical trauma. Iron stores are called upon during these periods to meet the body's increased demands.

They also play a key role in the body's homeostatic regulation of this nutrient. When these stores become depleted a person is considered "iron deficient" - but not anemic. It is only later when blood levels are affected that the individual is considered to suffer from iron deficiency anemia.

The actual prevalence of iron deficiency in the United States is likely an underestimation because the deficiency progresses in stages beginning with depletion of stores. However, it is the final stage that we most often measure (depressed hemoglobin, hematocrit or mean corpuscular volume).

Measurement

Since measurements of iron stores are costly and difficult to interpret, measures of the iron-containing substances in the blood are most often conducted. Hemoglobin is the substance usually examined for this purpose. However, a lag period exists between the time when iron stores are depleted and when hemoglobin levels begin to fall (55). The existence of this lag period means there are an unknown number of individuals with fully depleted stores who are not identified as anemic (due to their still normal hemoglobin levels). Therefore, the true magnitude of frank iron deficiency anemia is somewhat greater than estimates based upon hemoglobin, hematocrit, or MCV levels. As a result, it is likely that a significantly larger proportion of persons are suffering the cognitive and developmental consequences of iron deficiency than are currently believed to be. Furthermore, based upon our understanding of normal distributions it is evident that for each person exhibiting frank anemia, there are many more who are either borderline anemics, or who already have depleted iron stores.

For a more thorough discussion of the strengths and limitations of different biochemical methods of iron status determination, we refer you to the following report, prepared by an expert panel which was brought together by the Life Sciences Research Office of The Federation of American Societies for Experimental Biology (FASEB);

"Assessment of the Iron Nutritional Status of the U.S. Population Based on Data Collected in the Second National Health and Nutrition Examination Survey, 1976-1980" (60).

RESULTS

Hemoglobin

TOTAL RACES

6.3% of the rural poor had low hemoglobin levels. This compared to 2.8% of the

Fig. 5-1 Percent of Individuals Below Standard Cut-offs For Hemoglobin

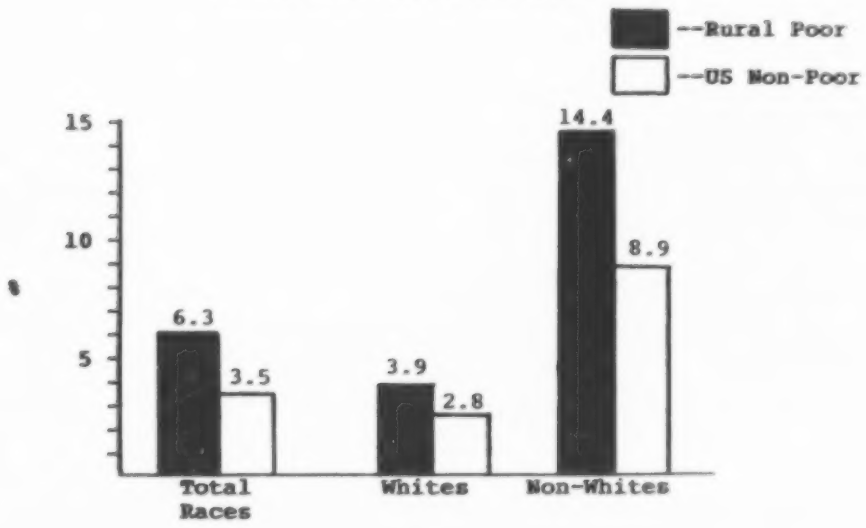
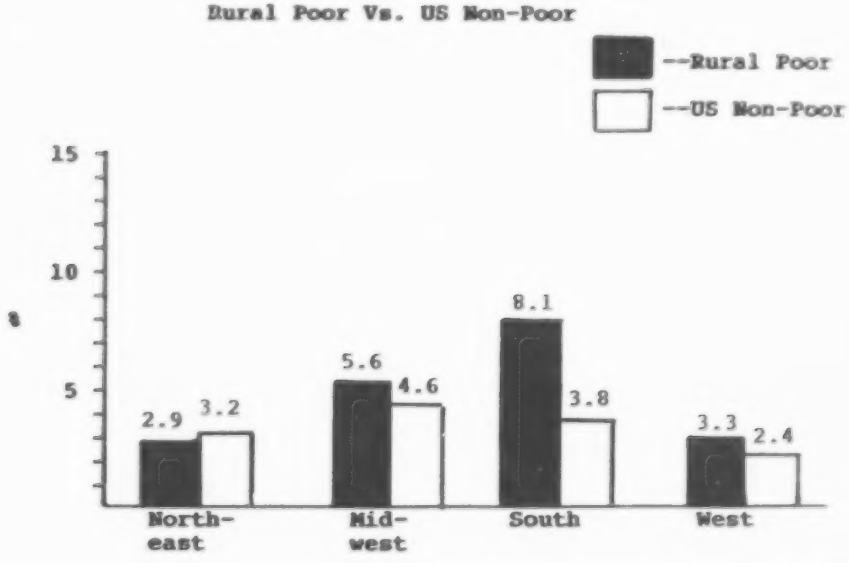


Fig. 5-1 Percent of Individuals Below Standard Cut-offs For Hemoglobin



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rural nonpoor population, and 3.5% of the entire U.S. nonpoor population. The difference between the rural poor and the non poor groups is statistically significant ($p<.0001$). (See Table 5-1, 5-2 and Figure 5-1)

White

While 3.9% of rural poor whites experienced low levels, 2.5% of rural nonpoor, and 2.8% of the entire U.S. nonpoor white populations had deficient hemoglobin levels.

Nonwhites

14.4% of rural poor nonwhites had below normal hemoglobin levels, compared to 8.0% of rural nonpoor nonwhites and 8.9% of the entire U.S. nonpoor nonwhite population.

DISCUSSION

Iron status as indicated by hemoglobin levels is a serious problem among the rural poor. The rural poor were 125% more likely to have low hemoglobin levels than the rural nonpoor population, and 80% more likely than the entire U.S. nonpoor population.

Furthermore, these results do not reflect the fact that particular age segments of the rural poor are likely to account for the majority of those who had hemoglobin levels below the cutoff. We know from several other surveys that iron deficiency is most prevalent among young children, pre-adolescent males, and women in their reproductive years (60). Thus it is likely that these rural poor subgroups experience even higher prevalences of iron deficiency and anemia.

Rural poor whites were approximately 38% more likely to have low hemoglobin levels than nonpoor whites, and 56% more likely than rural nonpoor whites. Our analyses indicate that the prevalence of low iron levels among rural poor nonwhites (14.4%) is considerably higher than among rural poor whites (3.9%). Also, hemoglobin levels below the cutoff were over 60% more common among rural poor nonwhites than among the nonpoor, nonwhite population.

Regionally, the prevalence of poor iron status is lowest among the rural poor living in the Northeast and Western part of the U.S. and is highest among those living in the South. Among rural poor nonwhites living in the Midwest and South, 18.8% and 19.5% respectively tested abnormally low.

Mean Corpuscular Volume (MCV)

TOTAL RACES

6.9% of the rural poor had MCV levels below the cutoff. This compared to 3.7% of the rural nonpoor and 3.4% of the entire U.S. nonpoor population. The difference between the rural poor and the nonpoor groups is significant ($p<.0001$). See Tables 5-1, 5-2 and Figure 5-2.

White

While 4.8% of rural poor whites had low MCV levels, 3.4% of rural nonpoor whites and 2.9% of the entire U.S. nonpoor white population had low levels.

Nonwhite

14% of the rural poor non whites had low MCV levels, while 12.5% of rural nonpoor nonwhites, and 7.3% of the entire U.S. nonwhite nonpoor population had levels below the cutoff.

DISCUSSION

Results for mean corpuscular volume levels were consistent with those for hemoglobin. Again, we found a higher prevalence of low MCV levels among the rural poor and the highest rate among the rural poor nonwhite population. Exceptions

Fig. 5-2 Percent of Individuals Below Standard Cut-offs For Mean Corpuscular Volume (MCV)

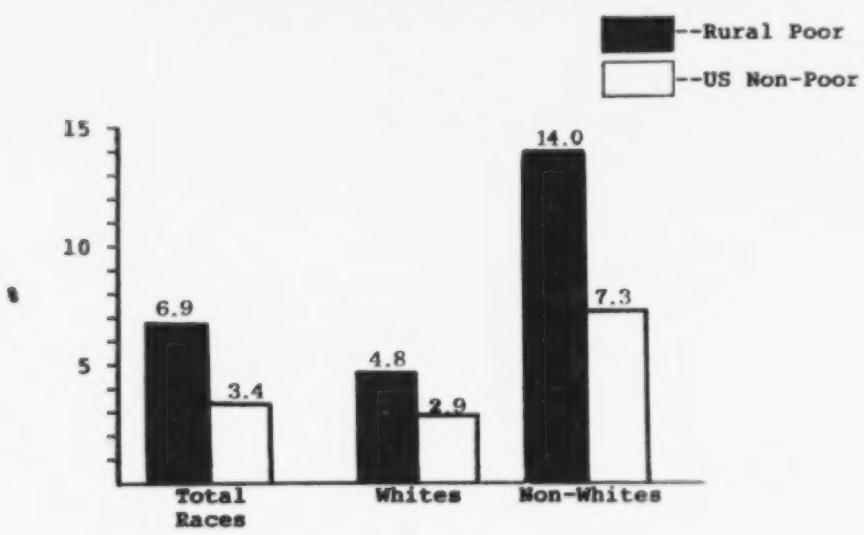
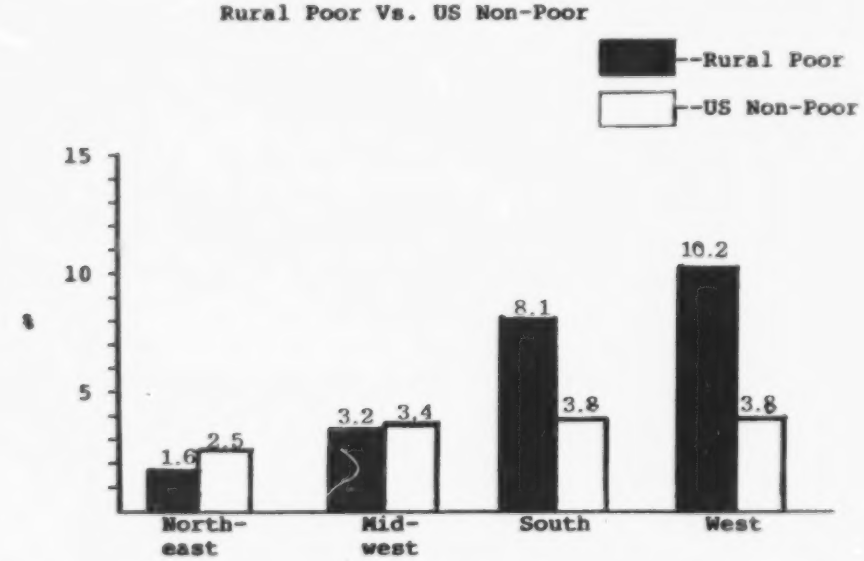


Fig. 5-2 Percent of Individuals Below Standard Cut-offs For Mean Corpuscular Volume (MCV)



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to this include the following:

- MCV values indicated that rural poor whites residing in the West were nearly 3 times as likely to be deficient as were nonpoor whites in that region.
- Based on MCV levels, the rural poor who reside in the Northeast and Midwest appeared to be at lower risk of iron deficiency than indicated by hemoglobin values. This was particularly true among whites.

Percent Transferrin Saturation (% TS)

TOTAL RACES

14.8 of the rural poor had % TS levels below the cutoff, compared to 9.8% of the rural nonpoor and 9.2% of the entire U.S. non poor population. The difference between the rural poor and both non poor groups is statistically significant ($p<.0001$) See Tables 5-1, 5-2 and Fig. 5-3

Whites

14.2% of the white rural poor had % TS levels below the cutoff compared to 9.7% of white rural nonpoor and 9.2% of the entire U.S. nonpoor white population.

Nonwhites

17.0% of the nonwhite rural poor had % TS levels below the cutoff, compared to 12.7% of the rural nonwhite, nonpoor population and 9.9% of the entire U.S. nonwhite, nonpoor population.

DISCUSSION

Although higher in absolute magnitude, results of percent transferrin saturation tests were consistent with those of hemoglobin and MCV. According to this indicator of iron status, presence of iron deficiency was experienced 60% more frequently by the rural poor than by our nation's nonpoor.

In agreement with our hemoglobin and MCV results, % TS revealed that rural poor non whites were significantly more likely to have low iron levels than were rural poor whites. Furthermore, this test indicated that rural poor nonwhites had poor iron status 71% more frequently than the nonpoor nonwhite population living in the U.S. In addition, whites living in conditions of rural poverty were more than 50% more likely to exhibit deficient iron levels, than were nonpoor whites overall.

Consistent with findings from MCV and hemoglobin levels, percent transferrin saturation test results indicate that the rural poor who reside in the Southern and Western parts of the nation experience the highest prevalence of poor iron status.

As discussed previously, the increased prevalance of low iron levels indicated by this measure is consistent with our understanding of the various physiological stages involved in iron depletion and iron deficiency anemia. Decreased levels of hemoglobin and mean corpuscular volume indicate the latter stages of iron deficiency (60). Prior to this stage, however, iron stores must first be depleted, which results in a state referred to as iron-deficient erythropoiesis.*

This stage can be recognized by abnormally low levels of plasma iron supply, of which depressed transferrin saturation levels are an indicator. Thus, low transferrin saturation levels indicate the middle stage of iron deficiency. At this point, iron stores have been exhausted, and production of an adequate supply of normal red blood cells has been compromised, but neither hematocrit nor hemoglobin levels have yet decreased.

Therefore, while hematocrit, hemoglobin

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* Erythropoiesis refers to the formation of the red blood cell (erythrocyte).

Fig. 5-3 Percent of Individuals Below Standard Cut-offs For Percent Transferrin Saturation (% TS)

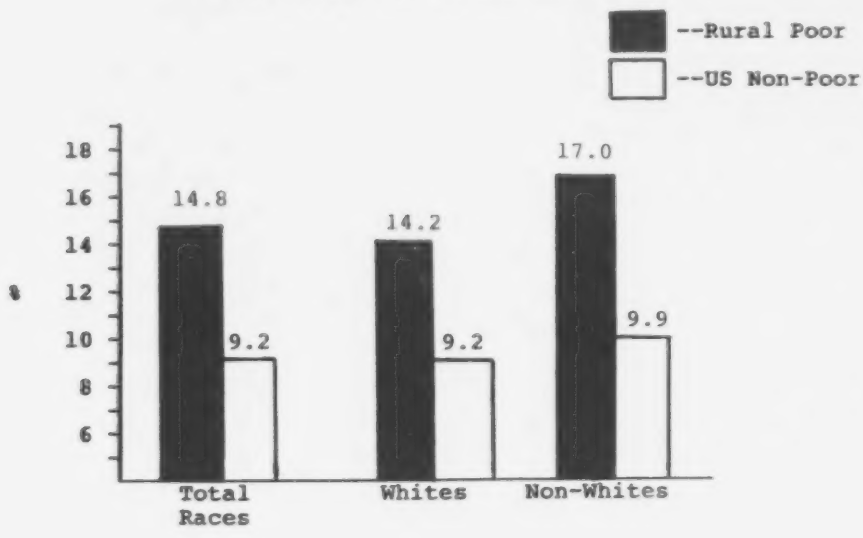
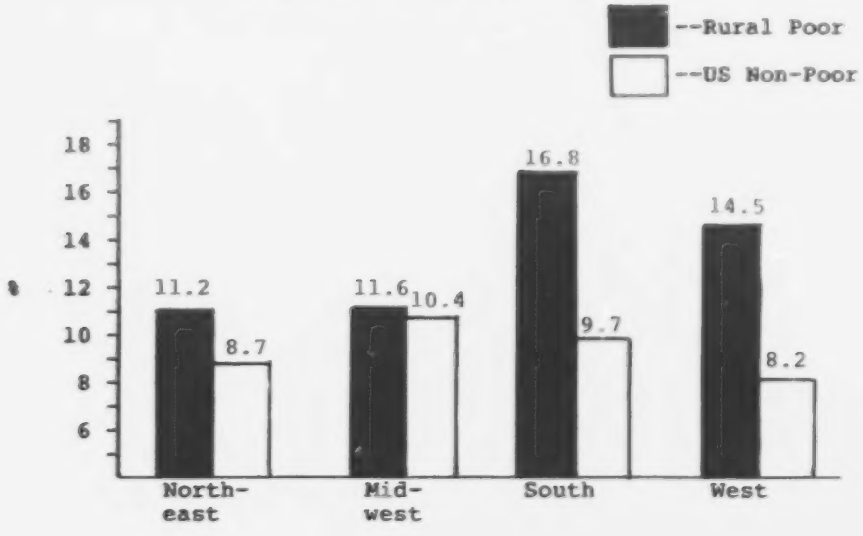


Fig. 5-3 Percent of Individuals Below Standard Cut-offs For Percent Transferrin Saturation (% TS)



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and MCV measure the prevalence of the final stage of iron deficiency, transferrin saturation is also able to indicate earlier stages of the deficiency, thus explaining the higher prevalence of deficiency as indicated by this measure.

Vitamin A

Existence of Deficiency

Deficiency of vitamin A is one of the most common nutritional problems throughout the world. In the United States, low serum vitamin A levels have been identified in a number of national surveys (59,62).

Inadequate consumption of vitamin A has also been identified among specific subpopulations in the Ten State Survey, NHANES I and II, the Nationwide Food Consumption Survey, and more recently in Hispanic NHANES.

Physiologic Role

Vitamin A has a number of principal functions in the body. It is essential for maintaining the normal condition of the mucous membranes throughout the body. In the eye, it is necessary for several visual processes, its deficiency leading to decreased dark adaptation, degeneration of the cornea, and eventually xerophthalmia, and blindness. This latter consequence of chronic, prolonged vitamin A deficiency is experienced widely throughout the developing world where an estimated 400,000-500,000 children are blinded each year from this deficiency (63).

Vitamin A is also necessary for normal bone growth, as well as healthy skin, tooth enamel, and integrity of cell membranes (56,64,65). Its deficiency has also been observed to result in growth deficits, GI tract problems, i.e. diarrhea, skin problems including follicular hyperkeratosis, and infections of the respiratory, and urogenital tracts (64).

The effects of Vitamin A deficiency are most severe around the time of birth. This is primarily due to the vitamin's key role during the time of rapid growth and development. Furthermore, during infancy and early childhood, recurrent infections of the GI tract caused by the deficiency, result in both increased requirements of the nutrient and decreases in its absorption due to damaged intestinal epithelium (56,65).

Measurement

Ideally, assessment of the status of Vitamin A should include measurement of total body reserves. This is because, like iron, circulating levels of the vitamin do not fall until stores (primarily stored in the liver) are completely depleted (64,65). As long as there are even minute amounts remaining in storage, methods which measure circulating levels of vitamin A,* will not indicate a depleted or marginal status. However, due to limitations in time and cost, the only practical laboratory test of Vitamin A status often is serum or plasma retinol determination. This was the method used in the NHANES II study.

Subsequently, those with marginal status, having little Vitamin A in storage - those particularly vulnerable to acute periods of food shortages, are not identified in our study. Rather, only those with decreased levels of circulating Vitamin A have been identified. As with iron deficiency, there is likely to be a somewhat larger population whose vitamin A status is less

* In the circulatory system vitamin A travels in the alcohol form called retinol.

than optimal. This group, however, cannot be identified by the methods used in NHANES II.

RESULTS

TOTAL RACES

44.8% of rural poor children* had low serum vitamin A levels. This compares to 28.9% of the rural nonpoor children and 28.2% of the total U.S. nonpoor population. The difference between the rural poor and both nonpoor groups is significant ($p<.0001$). See Tables 5-1, 5-2, and Figure 5-4.

Whites

46.2% of the rural poor white population had levels of serum vitamin A below the cutoff. This compares with 29.1% of the white rural nonpoor population and 26.6% of the total U.S. white nonpoor population.

Nonwhites

41.5% of the rural poor nonwhite population had serum vitamin A levels below the cutoff, compared to 26.2% of the nonwhite rural nonpoor population and 41.2% of the entire U.S. nonwhite, nonpoor population.

DISCUSSION

Our findings demonstrate that the prevalence of Vitamin A deficiency among rural poor children is extremely high. 44.8% of rural poor children between the ages of 3 and 11 years had deficient levels of this nutrient. Furthermore, rural poor children had a 58.9% greater likelihood of deficiency than did nonpoor children throughout the U.S.

The prevalence of abnormally low vitamin A levels was similar among rural poor whites and nonwhites. However, while poverty income was related to decreased status among whites, the relationship between poverty and low vitamin A status among rural nonwhites was inconsistent.

Rural poor children residing in the South had a considerably greater prevalence of low levels of serum vitamin A than did those in the other regions.*

VITAMIN C

Existence of Deficiency

Each of the major nutrition surveys conducted in the U.S. has demonstrated that inadequate consumption of vitamin C is common in this country, particularly among the poor. Furthermore, inadequate circulating levels of this nutrient have also been found to be prevalent among our nation's poor, with symptoms of scurvy observed in 4 percent of this population (29).

Physiologic Role

The importance of Vitamin C in human nutrition is well documented. Its role as an acid and as an antioxidant is required for numerous vital physiologic processes.

The best understood metabolic role of vitamin C is its function in the synthesis of the connective protein, collagen. Included among the key roles of this protein are; providing the matrix for bone formation, wound healing and scar formation, providing intercellular adhesive which maintains tissue stability particularly important in allowing artery and capillary walls to expand and contract along with the beating of the heart (56,64,65).

Vitamin C is also involved in the production of the adrenal hormones, epinephrine (adrenalin) and norepinephrin (noradrenalin),

* For vitamin A, the sample included only children age 3-11 years.

* Caution should be applied in the interpretation of regional data for this nutrient due to the small sample examined.

Fig. 5-4 Percent of Individuals Below Standard Cut-offs For Serum Vitamin A

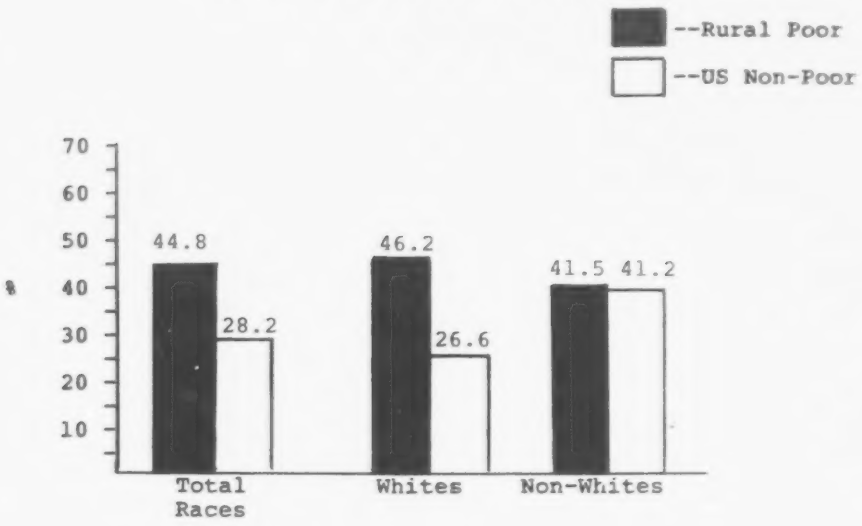
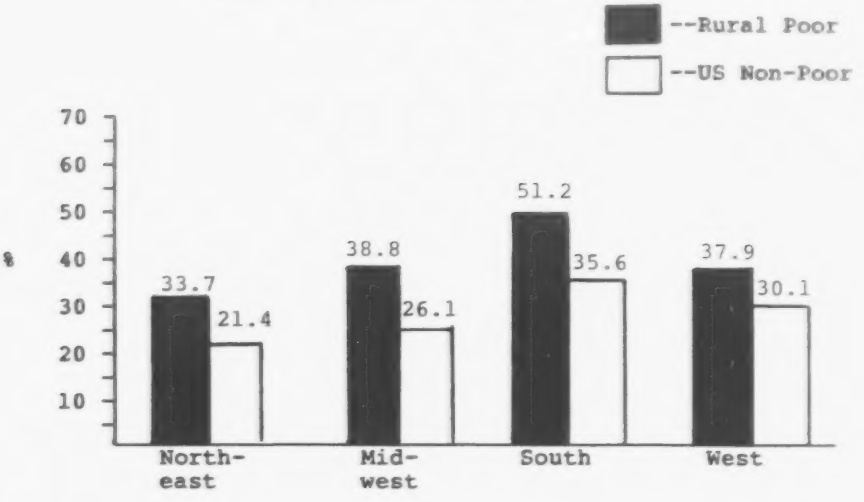


Fig. 5-4 Percent of Individuals Below Standard Cut-offs For Serum Vitamin A



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as well as for synthesis of the hormone thyroxin (64,65).

Other roles of the vitamin include its function in the deposition of calcium for bone and tooth formation, as well as in increasing the bio-availability of iron in foods (64). Because of this latter role, inadequate consumption of vitamin C can result in decreased iron absorption, leading to iron deficiency anemia.

Deficiency

The most well known consequence of Vitamin C deficiency is the development of a condition known as scurvy. The symptoms of scurvy include loss of the vitamin's role in maintaining capillary integrity, resulting in bleeding gums, and capillary hemorrhaging. If status of the vitamin continues to fall, "full-blown" scurvy ensues, the clinical manifestations of which include: further hemorrhaging (due to the inability to synthesize collagen), degeneration of muscle tissue throughout the body, impaired wound healing, and softening of the bones (leading to increased fractures) and teeth (54,64,65). Iron deficiency may also occur (64). In addition, the decreased ability to produce essential adrenal and thyroid hormones result in metabolic imbalances which lessen the ability of the individual to cope with physiologic stress (64).

Measurement

The level of vitamin C in white blood cells closely reflects body stores of this nutrient, however, its measurement is costly and demanding technically (25,30,34). The most commonly used laboratory test for vitamin C status (particularly in large surveys) involves the measurement of vitamin C levels in the serum or plasma.

This method is both reasonably sensitive and practical to conduct in a standardized manner. Subsequently, it was the method selected for use in the NHANES II survey.

RESULTS

TOTAL RACES

6.3% of the rural poor had low serum levels of vitamin C. This compared to 3.5% of the rural nonpoor and 2.5% of the entire U.S. nonpoor population. The difference between the rural poor and the nonpoor groups is significant ($p<.0001$). See tables 5-1, 5-2 and Fig. 5-5.

Whites

While 6.7% of the rural poor white population had low serum vitamin C levels, only 3.4% of rural nonpoor whites and 2.3% of the entire U.S. nonpoor white population had low levels.

Nonwhites

4.8% of rural poor nonwhites had levels below the cutoff, while 6.3% of rural nonpoor nonwhites and 3.5% of the entire U.S. nonpoor nonwhite population had low levels.

DISCUSSION

These analyses reveal that the prevalence of abnormally low serum ascorbic acid (Vitamin C) levels in the nonpoor U.S. population is relatively low (2.5%). However, among the rural poor, the prevalence is more than 150% greater (6.3%).

The problem is experienced more frequently by rural poor whites than by rural poor nonwhites (6.7% versus 4.8% respectively). In addition, rural poor whites are nearly 3 times as likely to have low serum levels of vitamin C than whites who are not poor (2.3% versus 6.7%).

The problem is greatest in the South,

Fig. 5-5 Percent of Individuals Below Standard Cut-offs For Serum Vitamin C

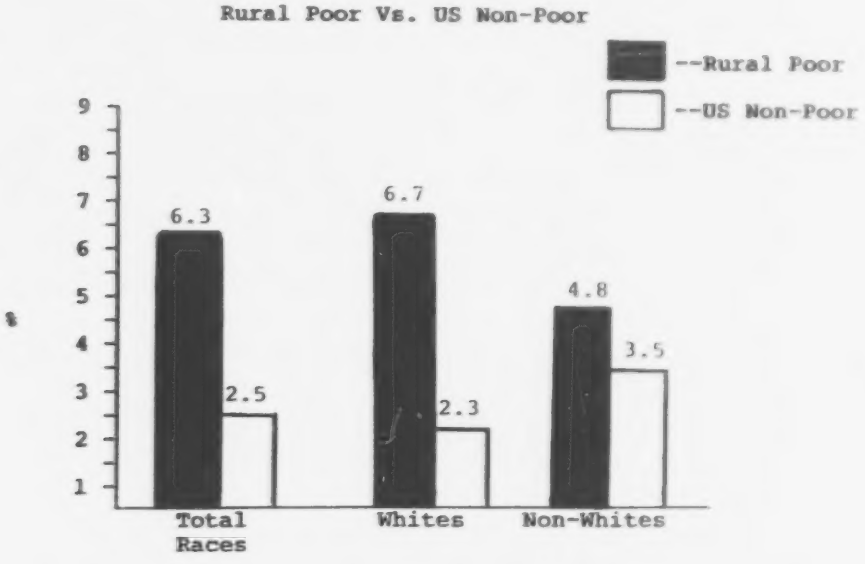
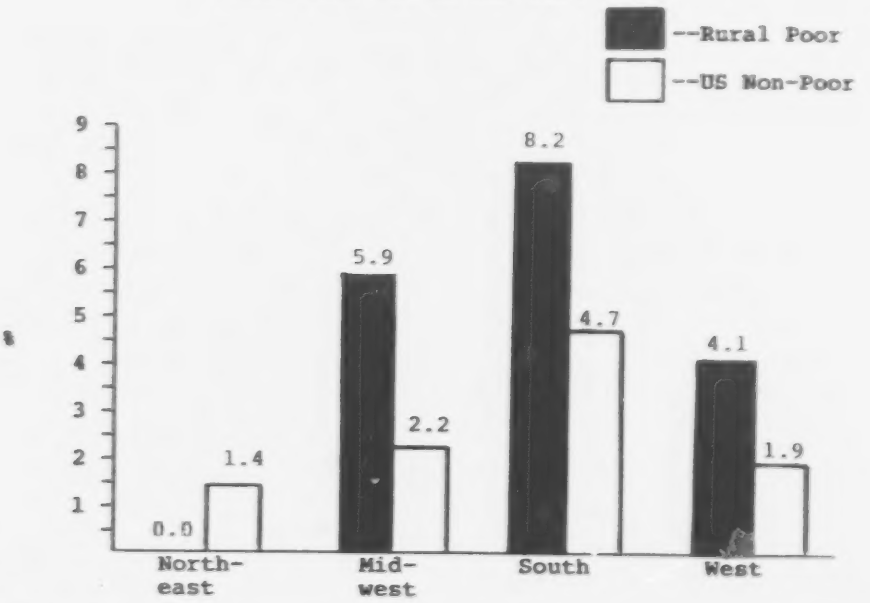


Fig. 5-5 Percent of Individuals Below Standard Cut-offs For Serum Vitamin C



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where 8.2% of the rural poor showed biochemical evidence of abnormally low levels. This compared to 4.6% of non poor whites, and 5.9% of the nonpoor rural whites living in that region, indicating that risk of vitamin C deficiency is greatest in the South overall.

ZINC

Existence of Deficiency

Severe zinc deficiency is reported to be rare in the U.S. However, numerous recent reports have concluded that certain subgroups within the U.S. population, namely the elderly, pregnant women, and young children, appear to be at less than optimal zinc status (61). Furthermore, the observation that the healing of wounds can be accelerated by treatment with a zinc compound also suggests that marginal zinc deficiency may be common in the U.S.

In light of recent observations of inadequate zinc consumption among particular subpopulations in the U.S. including the elderly, and the extreme over-representation of the elderly among the rural poor, (discussed in section 1) sufficient rationale exists to have selected this nutrient for study. Furthermore, the importance of adequate zinc nutrition for the maintainance of several key physiologic functions including pregnancy, wound healing, growth retardation and appetite provide pursuasive evidence for its inclusion in this study.

Zinc deficiency in humans was first observed in the Middle East, where its symptoms included severe growth retardation and hypogonadism. (67,68). Since that time, symptoms of the deficiency have also been shown to include weight loss, biochemical imbalances, dysfunction of connective tissue synthesis, dermatitis, skin infections, decreased testosterone levels, anorexia, and loss of taste and smell acuity (61).

Several studies have demonstrated that upon supplementation of the diet of those with apparent deficiencies with zinc, several beneficial effects ensue, including: decreased complications of pregnancy, improved growth among short children, more rapid healing, and increased taste sensitivity* (61).

Physiologic Role

Zinc exerts its primary roles in human physiology as an essential component of several metalloenzymes, including the pancreatic peptidases, carbonic anhydrase, alcohol dehydrogense, and others. Zinc is also involved in protein sysnthesis as well as in connective tissue metabolism (64,65).

Zinc is also necessary for the maintainence of normal circulating vitamin A levels. It is thought that zinc may be required for mobilization of vitamin A from storage in the liver. Another important role of zinc involves its binding to insulin to form a zinc-insulin complex which is believed to assist in the regulation of this hormone within the Beta cells of the pancreas (64,65).

Measurement

Laboratory criteria for the diagnosis of zinc deficiency ave not yet been clearly established. An expert scientific working group appointed by the Federation of American Societies of Experimental Biology

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* It should be noted that not all of these beneficial effects of zinc supplementation have been duplicated or confirmed. Thus, there remains some degree of skepticism and unresolve among the scientific and nutrition communities of the presence of deficiency and of the ameliorative effect of supplementation.

Fig. 5-6 Percent of Individuals Below Standard Cut-offs For Serum Zinc

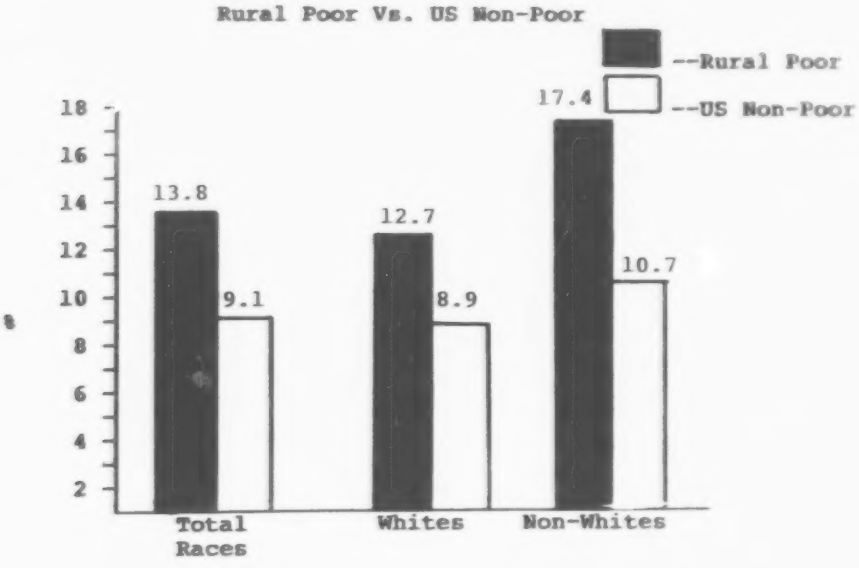
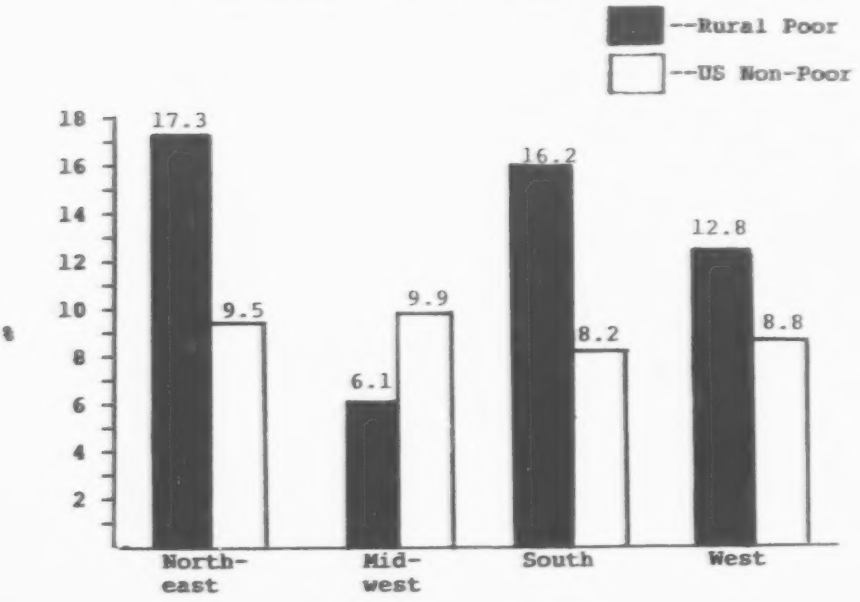


Fig. 5-6 Percent of Individuals Below Standard Cut-offs For Serum Zinc



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(FASEB) concluded that "while serum zinc values are useful for identifying groups whose zinc nutriture should be examined in greater depth," they also cautioned that "serum zinc values are not definitive for the assessment of zinc nutriture." (61) Although response to zinc therapy is probably the most reliable index, it is impractical to use as a survey tool. Therefore, serum or plasma zinc, while not flawless, offer simplicity and require only basic and well standardized laboratory procedures. Serum zinc was the index measured in NHANES II*.

RESULTS

TOTAL RACES

13.8% of the rural poor had deficient serum zinc levels. This compared with 8.6% of the rural nonpoor and 9.1% of the entire U.S. nonpoor population. The difference between the rural poor and the two nonpoor groups is significant ($p<.0001$). See Tables 5-1, 5-2 and Figure 5-6.

Whites

While 12.4% of the rural poor had serum zinc levels below the cutoff only, 8.5% of rural nonpoor whites and 9.1% of the entire U.S. nonpoor white population had low serum levels of this nutrient.

Nonwhites

17.4% of rural poor nonwhites had abnormally low levels of serum zinc. This compares with 11.5% of rural nonpoor nonwhites and 10.7% of the entire U.S nonpoor nonwhite population.

DISCUSSION

Based on biochemical levels of this nutrient in the serum, low zinc levels appear to be a serious and widely experienced problem among the rural poor. The rural poor were over 50% more likely to experience deficiency of this nutrient than were the nonpoor. This disparity is highly significant ($p.<.001$)

Rural poor nonwhites were over 60% more likely to have low zinc levels than nonwhites who had adequate incomes (17.4% vs 10.7%). The rural poor nonwhites were also considerably more likely to have low levels than were rural poor whites (17.4% vs 12.7%).

Regionally, status for this nutrient followed a very different pattern than that observed with the other nutrients: The rural poor who reside in the Northeast had the highest prevalence of low levels. This was particularly true of rural poor whites in that region. The Midwest rural poor exhibited the lowest prevalence of zinc deficiency.

SUMMARY ANALYSES

An additional analysis which was conducted to help summarize our biochemical findings involved the tabulation of the percentage within each group who fell below the cutoff for at least 1 biochemical measure,* as well as the percentage who

* Zinc levesl have been show to vary depending upon the time at which blood samples are drawn, with higher levels during AM hours and lower levels during PM hours (in most individuals). However, in this analysis, times at which specimens were drawn were not taken into account when analysing data. Therefore, while it is unlikely that the relative proportions of each group which had zinc levels below the cutoff was significantly affected by this methodilogical limitation a more rigous analysis of zinc status should take into account the diurnal cycle typical of its levels.

* Of the indicators of iron status studied, only hemoglobin was included in this analysis. Thus 4 tests in all were included: hemoglobin, serum zinc, serum vitamin A and serum vitamin C.

fell below the cutoff for at least 2 of the measures.** (Figure 5-7, 5-8).

These summary data reveal that the rural poor were significantly more likely to exhibit at least one deficiency than were the nonpoor ($p<.0001$). 24% of the rural poor had low levels for at least 1 nutrient (out of the 4 studied) compared to 14.1% of the nonpoor.

The rural poor were found to be 3.5 times as likely as the nonpoor to experience low levels of at least 2 of the four nutrients studied (3.5% vs 1.0%). This disparity was highly significant ($P<.0001$). The significance of this finding is underscored by the fact that multiple biochemical deficiencies in the same individual should be very rare.

Geographic Comparisons

Consistent with our findings regarding dietary intake, the biochemical results indicate that the prevalence of nutritional problems is lowest among the rural poor in the Northeast, followed closely by those in the Midwest. On the other hand, the prevalence of low circulating nutrient levels among the Southern rural poor is the highest; almost a third (29.2%) having at least 1 nutirent below the cutoff value, followed by those in the West of whom 20.0% had at least one nutrient below the cutoff.

When the number with two or more nutrients below the cutoffs is examined, again the rural poor of the of the Northeast and the Midwest faired the best with only 1.6% and 0.8% respectively experiencing at least 2 abnormally low nutrient levels. Whereas in the South and West the rural poor had the highest prevalences, with 5.2% of the Southern rural poor compared to 2.0% of the Western rural poor exhibiting low levels of at least two nutrients.

Racial Comparisons

Rural poor nonwhites had abnormally low levels of at least one nutrient over 40% more frequently than did rural poor whites (31.7% vs 22.3%).

This disparity closely parallels that observed between the two racial categories with regard to dietary consumption, (of which 29.2% of rural poor nonwhites vs 23.1% of rural poor whites failed to consume adequate levels of at least five nutrients).

We also found that rural poor nonwhites were more than twice as likely to experience at least two biochemical deficiencies as were rural poor whites (5.5% vs 2.8%). Whereas rural poor whites were more than three times as likely to experience multiple deficiencies than were non poor whites (2.8% vs .9%). This disparity also reached significance ($P<.0001$). For nonwhites the disparity was considerably larger in absolute terms (5.5% vs 2.2%), and was also significant ($P<.005$).

SUMMARY

Analysis of NHANES II biochemical and hematological data, show that the rural poor experience circulating nutrient levesl below standard cutoffs between 51.6% and 152.0% more frequently than do

** Because only 3-11 year olds were tested for serum vitamin A, the actual number of persons with nutrient deficiencies is higher than this analysis indicates (i.e., those not tested for vitamin A are treated by this analysis as though they had levels above the cutoff). Therefore, the true prevalence of those with at least one, and at least two biochemically determined deficiencies is likely to be considerably higher than indicated by these summary analyses.

TABLE 5-1

PERCENT OF INDIVIDUALS WITH BIOCHEMICAL OR HEMATOLOGICAL NUTRIENT LEVELS BELOW STANDARD CUTOFFS RURAL POOR VERSUS U.S. NON-POOR

DEMOGRAPHIC GROUP	HEMOGLOBIN		MCV[3]		PCT. TRANS. SAT.[4]		SERUM VIT. A		SERUM VIT. C		SERUM ZINC	
	RP/1	USNP/2	RP	USNP	RP	USNP	RP	USNP	RP	USNP	RP	USNP
ALL REGIONS												
TOTAL	6.3	** 3.5	6.9	** 3.4	14.8	** 9.2	44.8	** 28.2	6.3	** 2.5	13.8	** 9.1
WHITE	3.9	2.8	4.8	* 2.9	14.2	** 9.2	46.2	** 26.6	6.7	** 2.3	12.7	** 8.9
NONWHITE	14.4	* 8.9	14.0	** 7.3	17.0	* 9.9	41.5	41.2	4.8	3.5	17.4	* 10.7
# OF INDIVIDUALS EXAMINED[5]												
TOTAL	1171	10997	1169	10869	1000	9629	164	913	1044	9870	1006	9254
WHITE	908	9755	907	9651	778	8588	115	811	813	8771	781	8237
NONWHITE	262	1242	261	1219	222	1041	49	101	231	1099	225	1018
BY REGION												
NORTHEAST												
TOTAL	2.9	3.2	1.6	2.5	11.2	8.7	33.7	21.4	0.0	1.4	17.3	9.5
WHITE	3.1	2.9	1.7	2.5	10.9	9.0	30.8	17.8	0.0	1.3	18.9	9.5
NONWHITE	0.0	6.6	0.0	3.2	14.8	4.1	44.2	45.6	0.0	1.8	0.0	9.7
# OF INDIVIDUALS EXAMINED[5]												
TOTAL	109	2653	109	2623	97	2191	14	186	91	2401	88	2367
WHITE	101	2426	101	2403	90	2056	11	162	83	2193	81	2170
NONWHITE	8	227	8	221	8	135	3	24	8	207	8	197
MIDWEST												
TOTAL	5.6	4.6	3.2	3.4	11.6	10.4	38.8	26.1	5.9	2.2	6.1	9.9
WHITE	3.1	3.7	.6	2.8	10.3	10.3	35.7	23.9	4.8	2.1	5.9	9.4
NONWHITE	18.8	16.5	16.5	10.8	18.5	11.4	50.1	57.2	11.6	2.6	7.0	15.8
# OF INDIVIDUALS EXAMINED[5]												
TOTAL	233	2938	233	2933	196	2547	24	295	213	2680	193	2441
WHITE	196	2714	196	2709	164	2355	19	275	181	2473	161	2277
NONWHITE	37	224	37	224	32	192	5	19	33	207	31	164
SOUTH												
TOTAL	8.1	3.8	8.1	3.8	16.8	9.7	51.2	35.6	8.2	4.7	16.2	8.2
WHITE	4.4	2.8	5.2	3.2	16.9	10.2	50.7	37.0	9.8	4.6	14.0	8.2
NONWHITE	19.5	10.2	16.8	8.4	16.2	6.3	52.7	24.7	3.0	5.5	23.0	8.5
# OF INDIVIDUALS EXAMINED[5]												
TOTAL	620	2420	618	2341	521	2192	88	194	552	2143	552	2091
WHITE	467	2114	466	2050	398	1915	66	172	421	1881	422	1832
NONWHITE	153	306	152	291	123	277	22	22	131	262	131	259
WEST												
TOTAL	3.3	2.4	10.2	3.8	14.5	8.2	37.9	30.1	4.1	1.9	12.8	8.8
WHITE	4.1	1.8	11.2	3.2	12.9	7.2	50.1	28.3	3.4	1.7	12.9	8.5
NONWHITE	1.6	5.7	7.7	6.8	18.1	13.3	25.8	39.9	5.5	3.5	12.5	10.5
# OF INDIVIDUALS EXAMINED[5]												
TOTAL	209	2985	209	2972	186	2700	38	239	188	2646	173	2356
WHITE	144	2501	144	2489	127	2262	19	203	128	2224	117	1958
NONWHITE	64	484	64	483	59	438	19	36	60	422	55	398

Source: NHANES II

1 Rural Poor
2 U.S. Nonpoor Population
3 Mean Corpuscular Volume
4 Percent Transferrin Saturation
5 Sample weights have been applied to these data. Therefore, the data for "All Regions" are representative of the entire non-institutionalized U.S. population for ages sampled. Data presented by racial or geographic category are also representative within the respective category for the ages sampled.

* The difference between the rural poor and the nonpoor is significant at the .05 level.
** The difference between the rural poor and the nonpoor is significant at the .001 level.
Tests for significance were conducted only for "All Regions".

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TABLE 5-2

PERCENT OF INDIVIDUALS WITH BIOCHEMICAL OR HEMATOLOGICAL NUTRIENT LEVELS BELOW STANDARD CUTOFFS RURAL POOR VERSUS RURAL NON-POOR

DEMOGRAPHIC GROUP	HEMOGLOBIN		MCV[3]		PCT. TRANS. SAT.[4]		SERUM VIT. A		SERUM VIT. C		SERUM ZINC	
	RP/1	RNP/2	RP	RNP	RP	RNP	RP	RNP	RP	RNP	RP	RNP
ALL REGIONS												
TOTAL	6.3 **	2.8	6.9 **	3.7	14.8 **	9.8	44.8 *	28.9	6.3 **	3.5	13.8 **	8.6
WHITE	3.9 *	2.5	4.8	3.4	14.2 **	9.7	46.2 *	29.1	6.7 **	3.4	12.7 **	8.5
NONWHITE	14.4	8.0	14.0	12.5	17.0	12.7	41.5	26.2	4.8	6.3	17.4	11.5
# OF INDIVIDUALS EXAMINED[5]												
TOTAL	1171	3514	1169	3498	1000	3124	164	297	1044	3228	1006	3003
WHITE	908	3379	907	3368	778	3004	115	283	813	3114	781	2888
NONWHITE	262	134	261	130	222	120	49	14	231	115	225	115
BY REGION												
NORTHEAST												
TOTAL	2.9	3.2	1.6	2.6	11.2	9.7	33.7	16.4	0.0	1.4	17.3	11.3
WHITE	3.1	3.0	1.7	2.7	10.9	9.8	30.8	15.8	0.0	1.5	18.9	11.1
NONWHITE	0.0	7.3	0.0	0.0	14.8	6.9	44.2	100.0	0.0	0.0	0.0	16.4
# OF INDIVIDUALS EXAMINED[5]												
TOTAL	109	641	109	641	97	575	14	49	91	588	88	557
WHITE	101	617	101	617	90	553	11	49	83	566	81	538
NONWHITE	8	24	8	24	8	21	3	0	8	22	8	19
MIDWEST												
TOTAL	5.6	3.1	3.2	2.5	11.6	9.7	38.8	18.6	5.9	2.6	6.1	7.5
WHITE	3.1	3.0	.6	2.2	10.3	9.3	35.7	18.9	4.8	2.6	5.9	7.4
NONWHITE	18.8	8.8	16.5	21.8	18.5	32.8	50.1	0.0	11.6	0.0	7.0	15.1
# OF INDIVIDUALS EXAMINED[5]												
TOTAL	233	771	233	771	196	661	24	69	213	731	193	637
WHITE	196	760	196	760	164	651	19	68	181	721	161	626
NONWHITE	37	12	37	12	32	10	5	1	33	10	31	12
SOUTH												
TOTAL	8.1	3.2	8.1	4.7	16.8	11.6	51.2	41.1	8.2	6.1	16.2	9.4
WHITE	4.4	2.7	5.2	3.9	16.9	11.7	50.7	42.4	9.8	5.9	14.0	9.3
NONWHITE	19.5	10.8	16.8	19.1	16.2	11.2	52.7	26.2	3.0	10.2	23.0	10.3
# OF INDIVIDUALS EXAMINED												
TOTAL	620	1393	618	1378	521	1242	88	114	552	1264	552	1264
WHITE	467	1321	466	1310	398	1178	66	105	421	1203	422	1200
NONWHITE	153	72	152	65	123	64	22	9	131	61	131	64
WEST												
TOTAL	3.3	1.3	10.2	4.3	14.5	6.3	57.9	28.0	4.1	1.4	12.8	5.6
WHITE	4.1	1.3	11.2	4.4	12.9	6.1	50.1	28.1	3.4	1.3	12.9	5.5
NONWHITE	1.6	1.0	7.7	3.3	18.1	13.4	25.8	27.3	5.5	4.4	12.5	8.5
# OF INDIVIDUALS EXAMINED												
TOTAL	209	708	209	708	186	640	38	65	188	645	173	545
WHITE	144	681	144	681	127	622	19	61	128	624	117	524
NONWHITE	64	27	64	27	59	25	19	4	60	22	55	21

Source: NHANES II

1 Rural Poor
2 Rural Nonpoor Population
3 Mean Corpuscular Volume
4 Percent Transferrin Saturation
5 Sample weights have been applied to these data. Therefore, the data for "All Regions" are representative of the entire non-institutionalized U.S. population for ages sampled. Data presented by racial or geographic category are also representative within the respective category for the ages sampled.

* The difference between the rural poor and the nonpoor is significant at the .05 level.
** The difference between the rural poor and the nonpoor is significant at the .001 level. Tests for significance were conducted only for "All Regions".

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Fig. 5-7 Percent of Individuals With Circulating Levels of At Least One Measured Nutrient Below the Standard Cut-off

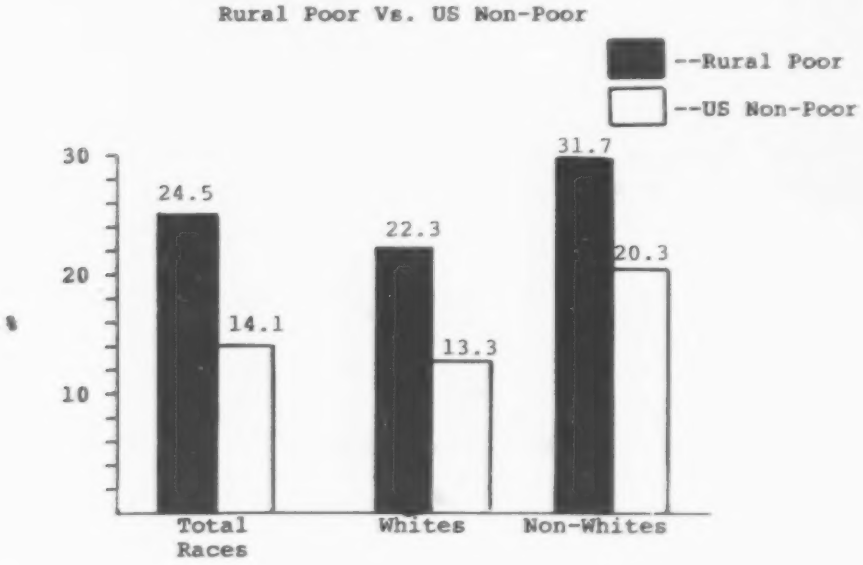

Fig. 5-7 Percent of Individuals With Circulating Levels of At Least One Measured Nutrient Below the Standard Cut-off

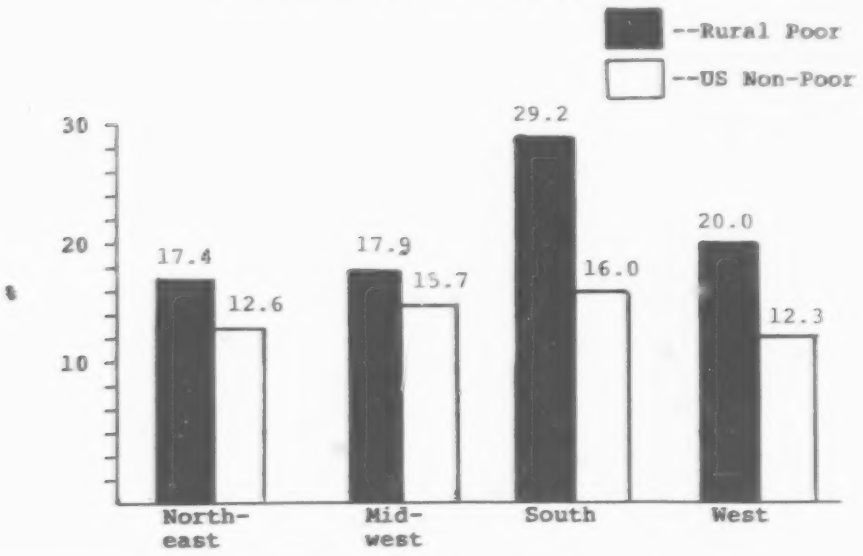

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Fig. 5-8 Percent of Individuals With Circulating Levels of At Least Two Measured Nutrients Below the Standard Cut-off

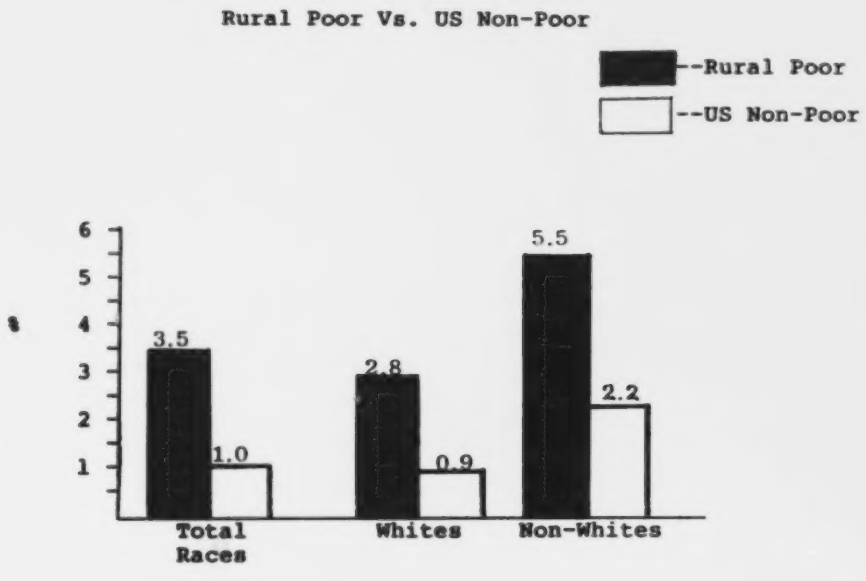
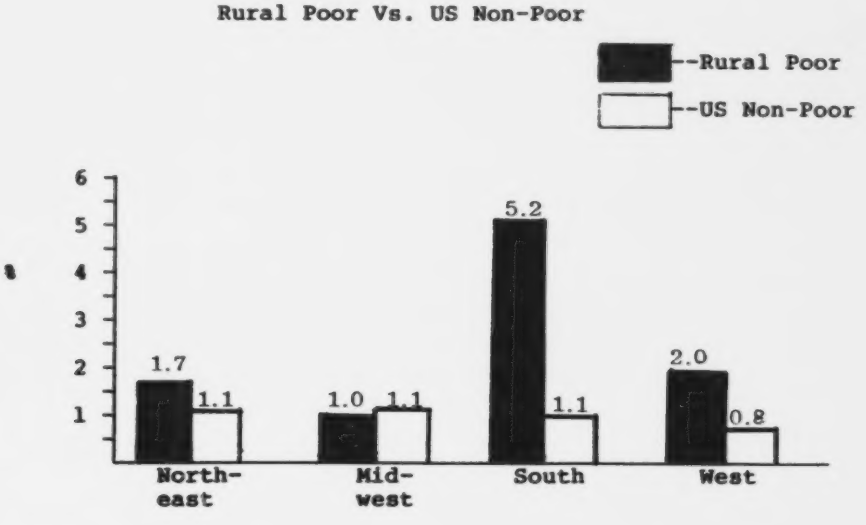


Fig. 5-8 Percent of Individuals With Circulating Levels of At Least Two Measured Nutrients Below the Standard Cut-off



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non poor U.S. residents overall. A consistent positive relationship was observed between these results and those of dietary intake. This was true with regard to the geographic, as well as racial distributions of dietary inadequacy and measured biochemical deficiency.

These findings demonstrate that the status of the rural poor with regard to each of the four nutrients is significantly worse than that of either the U.S. nonpoor or the rural nonpoor. In particular, poor vitamin A status appears to be the most serious, experienced by almost one of every two rural poor children. Furthermore, low levels of this nutrient are experienced 58.9% more frequently by rural poor children than by non poor children.

Of the remaining three nutrients studied, compromised status of zinc was found to be the most prevalent problem among the rural poor (13.8% had below cutoff levels). This rate was 51.6% higher among the rural poor than among the non poor. Deficient levels of vitamin C (6.3% vs 2.5%) were experienced greater than 150% more often by the rural poor, while the rural poor were found to have abnormally lowiron levels between 60.9% and 102.9% more frequently than the non poor, depending on the test used for measurement.

Geographic Distribution of Biochemically Indicated Deficiencies

The rural poor residing in the Northeast exhibited the lowest overall prevalence of deficient levels of the nutrients studied. These results are in agreement with our findings regarding dietary intake, in which the Northeastern rural poor appear to have higher quality diets than rural poor residents living elsewhere in the country.

Zinc status, as determined by circulating levels in the serum present an anomally to our findings. For this nutrient, the rural poor residing in the Northeast experienced the highest prevalence of below normal levels.*

The South was found to be the region in which rural poor residents had the highest prevalence of biochemical deficiencies. This was true for 2 of the 3 indicators of iron status, and for vitamins A and C. The Western rural poor exhibited low circulating nutrient levels somewhat less frequently than those of the South, followed by the Midwestern rural poor, who experienced deficienct levels intermediate between the Western and Northeastern rural poor.

Racial Distribution of Biochemically Indicated Deficiencies

These data show that rural poor non whites experience compromised iron and zinc status far more often than do rural poor whites. However, deficiency of vitamin C appears to be a significantly greater problem for rural poor whites (6.7% vs 4.8% deficient).

Our analyses also demonstrate that among rural poor whites, circulating levels of vitamin A are negatively related to income (i.e. while 46.2% of rural poor whites were deficient in this nutrient, only 26.6% of non poor whites had low levels). In contrast, among nonwhites, status of this vitamin was not related to income (41.5% of the rural poor vs 41.2% of the nonpoor had low levels). This racially linked difference was supported by our observations of dietary intake of this vitamin, in which rural poor consumption among whites was income related, whereas

* This study did not include dietary intake of zinc in its analysis.

among nonwhites it was not.

Based upon prevalence of levels below the cutoffs the major problem nutrients for rural poor nonwhites were found to be vitamin A, zinc, and iron. Although these same nutrients are most problematic among rural poor whites as well, vitamin C appears to be a more significant problem among rural poor whites, whereas iron is less of a problem among this group.

DISCUSSION

These analyses go further than to just demonstrate the disparities which were consistently observed between the rural poor and the nonpoor. They also reveal a striking and consistent correlation between findings from analysis of dietary intake data and analysis of circulating nutrient levels. A positive association between dietary inadequacy and biochemically determined deficiencies held within each region, as well as within racial categories.

These data demonstrate that the region in which the rural poor consumed the most adequate diet, (the Northeast) was also the region in which rural poor residents had the lowest prevalence of biochemically determined deficiencies. In contrast, the high prevalence of inadequate diets consumed by the rural poor residing in the South and West, closely paralleled the higher prevalences of low circulating nurtient levels experienced by the rural poor in those regions. The gap observed between the rural poor and the nonpoor held in every region for virtually each nutrient studied.

Chapter 6

ANTHROPOMETRIC MEASURES

RESULTS OF NHANES II ANALYSES

Chapter 6

ANTHROPOMETRIC MEASURES

RESULTS OF NHANES II ANALYSES

PRESENTATION OF DATA FROM NHANES II

Introduction

Two distinct anthropometric analyses were conducted. These include: height-for-age, and weight-for-height. With height-for-age, our interests were limited to finding the prevalence of children at the low end of the distribution (short stature), whereas analyses of weight-for-height involved determining the prevalence of those children at either end of the distribution (underweight or overweight).

A brief discussion regarding each of these measures, their usefulness and limitations, was presented in the methodology section of this report.

RESULTS

After presenting the results from the individual analyses, the data are compiled and presented in Tables 6-1 and 6-2.

Height-for-Age

TOTAL RACES

7.3% of poor rural children fell below the 5th percentile for this indicator of chronic undernutrition. This compared to 2.4% of rural nonpoor children and 2.8% of nonpoor children throughout the nation. (Refer to Tables 6-1, 6-2, and Figure 1). The difference between the rural poor and the other groups is statistically significant ($p<.001$).

Whites

While 6.7% of rural poor white children fell below the fifth percentile, 2.5% of rural nonpoor white children and 2.7% of white nonpoor children throughout the U.S. fell below that level.

Nonwhites

8.8% of rural poor nonwhite children fell below the fifth percentile for this index. This compared to 0.0% of rural nonwhite non poor children, and 3.1% of nonpoor, non white children throughout the nation.

DISCUSSION

Rural poor children were almost three times as likely to be growth stunted, as were children from nonpoor families. Although short stature was observed more frequently among rural poor nonwhites (8.8%) than among rural poor whites (6.7%), the magnitude of the disparity between income groups was felt equally between whites and nonwhites. A comparison of rural poor children to their nonpoor rural counterparts demonstrated even greater disparities (6.7% vs 2.5% for whites and 8.8% vs 0.00% for nonwhites).

Geographic Profile

The South appears to be the most affected region. This was true for rural poor whites, among whom 8.4% fell below the fifth percentile, as well as non whites, of whom 9.4% were below the fifth percentile. The latter group merits particular notice in light of the complete absence of nonpoor, nonwhite rural children who exhibited growth stunting. Moreover, of the entire sample of non poor, nonwhite Southern children (rural and total U.S.),

Fig. 6-1 Percent of Children Below the Fifth Percentile For Height-for-Age

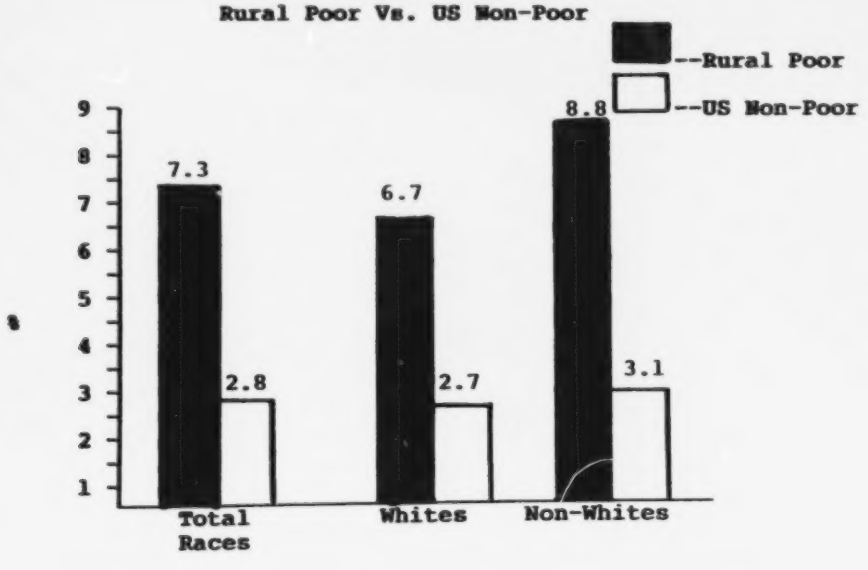
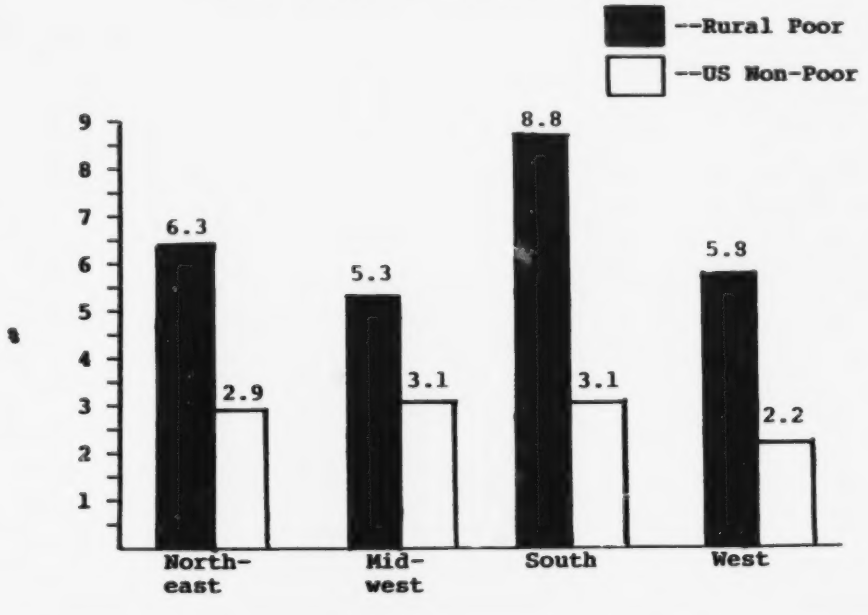


Fig. 6-1 Percent of Children Below the Fifth Percentile For Height-for-Age



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the prevalence of height-for-age below the 5th percentile was extremely low (0.3 percent).

Weight-for-Height Below the Fifth Percentile (Wasting)

TOTAL RACES

3.6% of rural poor children were below the fifth percentile for this index. This compared to 3.5% of rural nonpoor children and 3.4% of all U.S. nonpoor children. (See Tables 6-1, 6-2 and Fig.6-2).

Whites

4.3% of white rural poor children compared to 3.5% of nonpoor rural white children and 3.5% of all nonpoor white children throughout the U.S. were below this level.

Nonwhite

While 2.0% of nonwhite poor rural children were below this level, 3.6% of nonpoor non white rural children were, as were 3.0% of all nonpoor nonwhite children.

DISCUSSION

Our results indicate that there appears to be no problem with respect to wasting among rural poor pre-adolescent children, since the percentages are below or close to the expected five percent. Furthermore, differences in the prevalence of this indicator between rural poor and nonpoor did not reach statistical significance for any of the racial or regional subgroups analyzed.

The only group which showed evidence of problems for this index were rural poor Southern whites. Of this group, 6.1% fell below the 5th percentile, compared to 4.2% of their nonpoor counterparts.

We conclude that with the exception of whites who resided in the South, rural poor pre-adolescents did not appear to be at increased risk for inadequate weight-for-height.

Weight-for-Height Above the 95th Percentile (Obesity)

TOTAL RACES

6.9% of rural poor children were above this level. This compares to 4.0% of rural nonpoor children and 5.1% of non poor children throughout the entire U.S. (See Tables 6-1, 6-2 and Fig. 6-3).

Whites

6.7% of rural poor white children, compared to 3.5% of rural nonpoor white children and 4.1% of nonpoor white children throughout the nation were above the 95th percentile.

Nonwhites

7.4% of rural poor nonwhite children, compared to 14.3% of rural nonpoor, nonwhite children and 12.1% of nonpoor nonwhite children throughout the nation were above the 95th percentile for this index.

DISCUSSION

These data indicate that obesity is a moderately experienced problem among rural poor children. While 4.0% of rural nonpoor children and 5.1% of the nonpoor children throughout the U.S. were above the 95th percentile for weight-for-height, 6.9% of their poor rural counterparts were so classified.

Nonwhites in both income groups were more likely than whites to be overweight. However, it is worth noting that among nonwhites, poverty and overweight were negatively related, while among whites, a positive relationship was observed.

SUMMARY AND INTERPRETATION OF ANTHROPOMETRIC DATA

Height-for-Age

Inspection of the height-for-age data generated from our analyses reveal an exceptionally large disparity between the

Fig. 6-2 Percent of Children Below the Fifth Percentile For Weight-for-Height (Wasting)

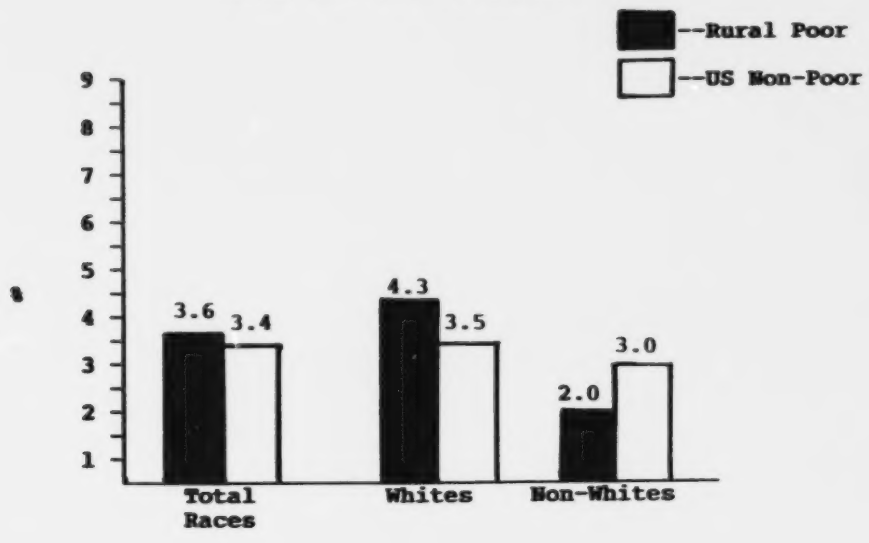

Fig. 6-2 Percent of Children Below the Fifth Percentile For Weight-for-Height (Wasting)

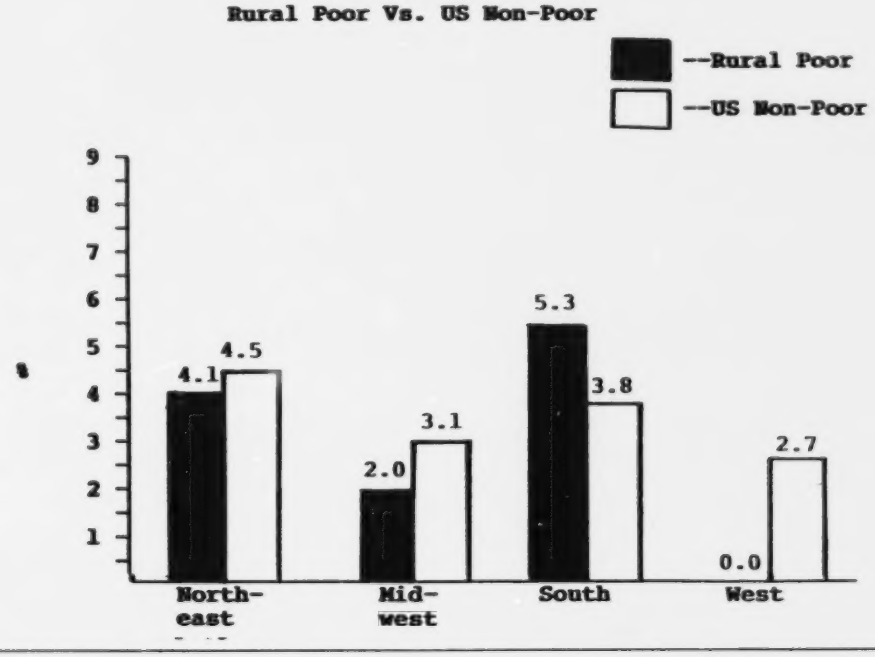

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Fig. 6-3 Percent of Children Above the Ninety-fifth Percentile For Weight-for-Height (Overweight)

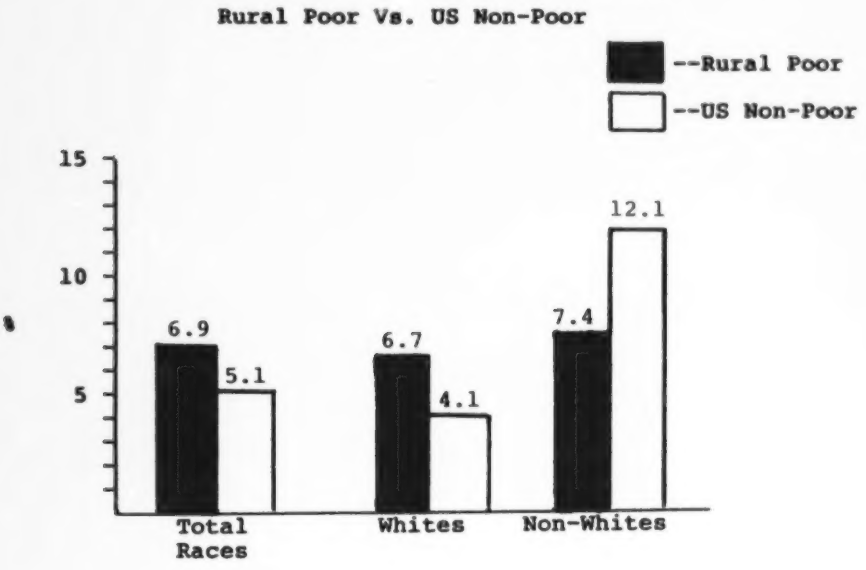
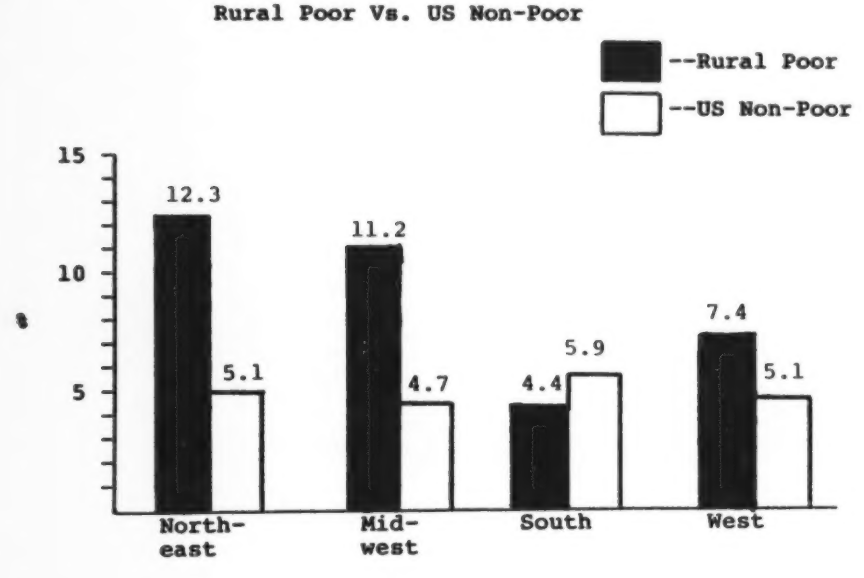


Fig. 6-3 Percent of Children Above the Ninety-fifth Percentile For Weight-for-Height (Overweight)



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rural poor and the nonpoor. These findings provide strong evidence that growth stunting is significantly more prevalent among rural poor children than among nonpoor children throughout the nation.

As previously discussed, the fact that 7.3% of rural poor children were below the fifth percentile probably understates the number of children experiencing the earlier, more subtle effects of undernutrition, which include decrements in activity level, intellectual curiousity, and development (42). These changes serve as an adaptive mechanism to conserve the growing body's energy stores, so that growth and other vital physical processes are not compromised.

Geographic Profile

Consistent with dietary and biochemical findings, the Southern rural poor exhibited the highest prevalence of low height-for-age (8.8%). Not only was low height-for-age significantly more prevalent among rural poor poor children residing in the South, but the gap between the non poor and the rural poor was also larger in that region than in any of the other regions. However, in contrast to the dietary and biochemical results, the Northeastern rural poor exhibited the second highest prevalence of growth stunting, with 6.3% below the fifth percentile. The rural poor residing in the Midwest had the lowest prevalence, with 5.3%.

Racial Profile

Rural poor nonwhites were considerably more likely to experience growth stunting than were rural poor whites. (8.8% vs 6.7%). However, this index was similarly linked to income groups for both whites and nonwhites. In each racial group, the rural poor were more than twice as likely to be below the fifth percentile than were the nonpoor (6.7% vs 2.7 for whites and 8.8% vs 3.1% for nonwhites).

Weight-for-Height Below the Fifth Percentile

Our data demonstrate that low weight-for-height was no more frequent among rural poor children than among the nation's children as a whole. However, regional analysis showed that rural poor children residing in the South did have a higher than expected prevalence of wasting (5.3%). While this excess over the expected level is not significant, it indicates that specific age subgroups within that region may be at increased risk.

Weight-for-Height Above the Ninety-fifth Percentile

Review of the findings from this data set indicate that rural poor children were somewhat more likely to be overweight than were nonpoor children (6.9% vs 5.1%). This condition was most prevalent among Northeastern rural poor children, of whom 12.3% were above the ninety-fifth percentile. In contrast, rural poor children residing in the South experienced the lowest prevalence of overweight (4.4%). The South was also the only region in which the rate of obesity was higher among nonpoor children than among poor rural children. (5.9% vs 4.4%).

Rural poor children in the Midwest had the second highest prevalence of obesity (11.2%), with those residing in the West following the South for the lowest prevalence (9.4%).

Racial Profile

The principle distinction observed between the two racial groups was that among whites, obesity was inversely related to income group (i.e., rural poor having a higher prevalence), whereas among nonwhites,

the two were positively associated (i.e., the rural poor having the lower prevalence). Nevertheless, overall, rural poor non whites were more likely to be overweight than were rural poor whites (7.4% vs 6.7%).

These data indicate that while not a serious problem, early development of obesity among the rural poor does merit concern and further monitoring.

TABLE 6-1

ANTHROPOMETRIC INDICATORS OF NUTRITIONAL STATUS

(Rural Poor vs U.S. Nonpoor)

ALL REGIONS	Percent of Children Below the 5th Percentile: HEIGHT-FOR-AGE		Percent of Children Below the 5th Percentile: WEIGHT-FOR-HEIGHT		Percent of Children Above the 95th Percentile: WEIGHT-FOR-HEIGHT	
	RURAL POOR	US NONPOOR	RURAL POOR	US NONPOOR	RURAL POOR	US NONPOOR
TOTAL	7.3 **	2.8	3.6	3.4	6.9	5.1
WHITE	6.7 **	2.7	4.3	3.5	6.7	4.1
NONWHITE	8.8 *	3.1	2.0	3.0	7.4	12.1
NUMBER OF INDIVIDUALS EXAMINED[1]						
TOTAL	519	3067	247	1470	247	1470
WHITE	359	2696	177	1279	177	1279
NONWHITE	160	371	70	191	70	199
NORTHEAST						
TOTAL	6.3	2.9	4.1	4.5	12.3	5.1
WHITE	5.9	2.9	3.7	4.7	13.3	3.5
NONWHITE	9.4	2.0	6.0	2.4	7.8	18.4
NUMBER OF INDIVIDUALS EXAMINED[1]						
TOTAL	56	683	26	325	26	325
WHITE	48	614	22	290	22	290
NONWHITE	8	68	4	35	4	35
MIDWEST						
TOTAL	5.3	3.1	2.0	3.1	11.2	4.7
WHITE	5.4	2.9	2.5	2.9	10.3	4.3
NONWHITE	4.4	5.9	0.0	10.0	14.6	9.1
NUMBER OF INDIVIDUALS EXAMINED[1]						
TOTAL	89	873	40	423	40	423
WHITE	73	811	32	391	32	391
NONWHITE	16	62	8	32	8	332
SOUTH						
TOTAL	8.8	3.1	5.3	3.8	4.4	5.9
WHITE	8.4	3.4	6.1	4.2	4.7	4.3
NONWHITE	9.4	0.3	3.0	1.6	3.5	14.9
NUMBER OF INDIVIDUALS EXAMINED[1]						
TOTAL	279	658	135	312	135	312
WHITE	189	579	98	265	98	265
NONWHITE	91	79	37	47	37	47
WEST						
TOTAL	5.8	2.2	0.0	2.7	7.4	5.1
WHITE	2.8	1.8	0.0	3.0	4.1	4.2
NONWHITE	9.0	3.8	0.0	1.3	11.6	8.8
NUMBER OF INDIVIDUALS EXAMINED[1]						
TOTAL	95	854	46	410	46	410
WHITE	49	691	26	333	26	333
NONWHITE	46	163	20	77	20	77

Source: NHANES II

1 Sample weights have been applied to these data. Therefore, data for "All Regions" are representative of the entire non-institutionalized U.S. population for ages sampled. Data presented by racial or geographic category are also representative within the respective category for the ages sampled.

* The difference between the rural poor and the nonpoor is significant at the .05 level.

** The difference between the rural poor and the nonpoor is significant at the .001 level. Tests for significance were conducted only for "All Regions".

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TABLE 6-2

ANTHROPOMETRIC INDICATORS OF NUTRITIONAL STATUS

(Rural Poor vs Rural Nonpoor)

	Percent of Children Below the 5th Percentile: HEIGHT-FOR-AGE			Percent of Children Below the 5th Percentile: WEIGHT-FOR-HEIGHT		Percent of Children Above the 95th Percentile: WEIGHT-FOR-HEIGHT	
ALL REGIONS	RURAL POOR		RURAL NONPOOR	RURAL POOR	RURAL NONPOOR	RURAL POOR	RURAL NONPOOR
TOTAL	7.3	**	2.4	3.6	3.5	6.9	4.0
WHITE	6.7	**	2.5	4.3	3.5	6.7	3.5
NONWHITE	8.8	*	0.0	2.0	3.6	7.4	14.3
NUMBER OF INDIVIDUALS EXAMINED[1]							
TOTAL	519		977	247	462	247	462
WHITE	369		935	177	438	177	438
NONWHITE	160		41	70	24	70	24
NORTHEAST							
TOTAL	6.3		3.3	4.1	1.7	12.3	1.1
WHITE	5.9		3.5	3.7	1.3	13.3	1.1
NONWHITE	9.4		0.0	6.0	34.8	7.8	0.0
NUMBER OF INDIVIDUALS EXAMINED[1]							
TOTAL	56		188	26	93	26	93
WHITE	48		180	22	91	22	91
NONWHITE	8		8	4	1	4	1
MIDWEST							
TOTAL	5.3		1.9	2.0	6.0	11.2	4.3
WHITE	5.4		1.9	2.5	6.1	10.3	3.2
NONWHITE	4.4		0.0	0.0	0.0	14.6	100.0
NUMBER OF INDIVIDUALS EXAMINED[1]							
TOTAL	89		209	40	89	40	89
WHITE	73		207	32	88	32	88
NONWHITE	16		2	8	1	8	1
SOUTH							
TOTAL	8.8		3.0	5.3	3.8	4.4	4.4
WHITE	8.4		3.2	6.1	4.1	4.7	3.5
NONWHITE	9.4		0.0	3.0	0.0	3.5	13.0
NUMBER OF INDIVIDUALS EXAMINED[1]							
TOTAL	279		374	135	188	135	188
WHITE	189		351	98	171	98	171
NONWHITE	91		24	37	17	37	17
WEST							
TOTAL	5.8		1.0	0.0	2.2	7.4	6.0
WHITE	2.8		1.1	0.0	1.8	4.1	6.1
NONWHITE	9.0		0.0	0.0	9.2	11.6	4.5
NUMBER OF INDIVIDUALS EXAMINED[1]							
TOTAL	95		204	46	93	46	93
WHITE	45		196	26	88	26	88
NONWHITE	46		8	20	4	20	4

Source: NHANES II

1 Sample weights have been applied to these data. Therefore, data for "All Regions" are representative of the entire non-institutionalized U.S. population for ages sampled. Data presented by racial or geographic category are also representative within the respective category for the ages sampled.

* The difference between the rural poor and the nonpoor is significant at the .05 level.
** The difference between the rural poor and the nonpoor is significant at the .001 level. Tests for significance were conducted only for "All Regions".

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Chapter 7

LOW BIRTHWEIGHT AND INFANT MORTALITY

Before presenting the results of our analyses regarding low birthweight (LBW) and infant mortality (IM) rates among the rural poor, the use of these unfavorable health outcomes as indicators of nutritional status will be addressed.

RATIONALE

There are numerous interacting, genetic and environmental factors which impact upon birth outcome. Along with smoking, teenage pregnancy, and inadequate health care, nutritional status is widely recognized as being a major factor. The overwhelming interest in its role prior to and during gestation, and during the first years of life attest to its perceived significance by the medical community. Numerous studies have demonstrated the causal link between malnutrition, low birthweight, and infant mortality (42-47).

Infant Mortality

Since the early part of the century, the infant mortality rate (IMR)* has been regarded as a barometer of the adequacy of a population's overall nutrition and health as well as a primary indicator of the effectiveness of a nation's (or community's) health care system. Professor Sam Shapiro, a noted expert in health policy and infant mortality at the Johns Hopkins School of Hygiene and Public Health, recently echoed this view when he commented on the importance of the IMR as a measure of "health status on a national or local level and in different subgroups of the population." He further stated that infant mortality "is a sensitive indicator of the effect of changes in economic conditions and medical care." The infant mortality rate is also particularly useful because it is one of the most consistently collected health data indices throughout the world (48).

Low Birthweight

Low birthweight (LBW)* also serves as a useful index of a population's health and nutrition status. It is a particularly effective indicator of nutrition and health status of women prior to and during pregnancy. It is widely agreed that nutrition is an important determinant of pregnancy outcome. It is also well documented that both the pre-pregnancy nutritional status of the mother and her diet during pregnancy are related to the risk of bearing a low birthweight infant (43,45,47,53). This relationship is no longer a subject of controversy, and has long been acccepted throughout the medical and public health community. According to the National Center for Health Statistics, "An infant's weight at birth is a primary determinant on survival and health throughout infancy and early childhood. The lower the birthweight, the greater are the chances of death, serious congenital anomolies, or other severe impairments" (54). A

* IMR = Infant deaths per 1,000 live births.

* LBW is defined as less than 2,500 grams (5 1/2 pounds). The LBW rate is measured per 100 live births.

recent report by the National Academy of Sciences concluded that "The association of neural developmental handicaps and congenital anomolies with low birthweight has been well established; low birthweight infants also may be susceptible to a wide range of other conditions, such as lower respiratory tract infections, learning disorders, behavior problems and complications of neonatal intensive care interventions. Moreover, a low-weight birth and the infant's subsequent problems may place substantial emotional and financial stress on a young family" (48). The extent of this increased risk has been confirmed by numerous other studies, including a 1979 report by the Surgeon General on Health Promotion and Disease Prevention (49). The report states that a LBW infant is 20 times more likely to die during the first year of life than an infant born at normal birthweight. LBW infants also account for approximately two- thirds of all neonatal deaths,* and more than one-half of all infant deaths in the U.S. (50)

The causal relationship between nutrition and pregnancy outcome is also widely recognized by policymakers who work in the areas of poverty, hunger, and nutrition. A report on infant mortality by the Congressional Research Service states that "although an undernourished mother may produce a healthy child, studies of nutrition status of women during pregnancy have shown a definite relationship between the adequacy of the mother's diet during certain stages of pregnancy and the condition of the baby at birth. Fetal growth is affected by maternal food intake..." (51).

Nutrition and Birthweight

This consensus recently received further support by a prestigious expert group of medical and nutrition professionals organized by the National Academy of Science's Institute of Medicine, and was described in the 1985 report Preventing Low Birthweight (47). According to the report, upon extensive review of the body of research which has examined the relationship between nutrition and low birthweight, the group concluded that "good nutrition has a positive influence on birthweight, but the magnitude of the effect is unclear".

Another supporting view of the relation ship was given before Congress earlier this year by Dr. William Dietz Jr., Assistant Professor of Pediatrics, Tufts University School of Medicine and Director of Clinical Nutrition in the Dept. of Pediatrics at the New England Medical Center in Boston, when he stated that "Although undernutrition in the United States is not as prevalent or severe as that observed during famines, even here the nutritional status of the mother has a major impact on the birthweight of the infant." (15).

Poor weight gain during pregnancy has been found to be closely related to decreased fetal weight gain. In addition, data from the NCHS's Collaborative Perinatal Study has clearly demonstrated that increased maternal weight gain is linked to increased birthweight, and to decreased neonatal mortality (52). The NCHS study also found that women who gained less than 14 pounds during pregnancy were 4 times as likely to give birth to a low birthweight infant than were mothers who gained between 30 and 35 pounds. Put simply, a pregnant mother can only support the optimal growth

* Deaths occurring during the first 28 days of life.

of her fetus if her own nutritional status is adequate.

Additional empirical studies confirm these findings. Among these, Taffel and Keppel of the National Center for Health Statistics demonstrated that "after controlling for mother's prepregnancy weight, age, education period of gestation, live birth order, and infant's sex, mothers who gained less than 21 pounds were still 2.3 times as likely to bear low birthweight infants as mothers who gained at least 21 pounds. Thus it appears that weight gain is one of the most important correlates of birthweight" (53). Based on their findings, these researchers assert that since a mother's prepregnancy weight and nutritional status impacts upon birth outcomes, studies which consider only weight gain and its relationship to nutritional status during pregnancy are limited in what they can explain about the importance of nutritional status for optimal birth outcome.

An expert panel appointed by the National Academy of Sciences (NAS) concluded that "the magnitude of nutritional effects on low birthweight is not easily assessed because nutritional status is difficult to isolate from other socioeconomic characteristics and because of the complicated relationship between prepregnant weight and weight gain during pregnancy. While researchers have found positive correlations between birthweight and nutritional status, there is wide variability in the degree of these associations. A reasonable conclusion is that poor nutritional status before pregnancy and inadequate nutritional consumption during pregnancy appear to have a negative impact on fetal weight gain, thereby increasing the risk of low birthweight" (47).

In summing up his testimony to Congress, Dr. William Dietz of the New England Medical Center stated that

> "Malnutrition in the Third World is associated with a high rate of infant mortality. Until recently I would have said there was little evidence that mild to moderate undernutrition in the pediatric population of the United States influenced infant mortality. However, rises in the rate of infant mortality in Boston and elsewhere have recently been demonstrated. Such increases have coincided with the increases in the prevalence of undernutrition. Therefore, we cannot complacently dismiss the possiblity that undernutrition increases infant mortality rates in the United States, particularly among poor populations, just as it does in the developing world" (15).

RESULTS

The results of our analyses of infant mortality and low birthweight trends in rural poor counties are presented differently than were those of NHANES II data. They are presented in three parts: rural poor county data first, then data for the rest of the nation (U.S. minus rural poor counties), then data for the entire U.S. For each section, the results are presented for all races combined, and by the racial categories white, non-white and black.* (Tables 7-1, 7-2, 7-3 and figure 1).

A list of the counties included in these analyses is presented in Appendix A. (Several economic characteristics of the counties are also included).

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* Racial categories are defined as follows:

White = all Anglo and Hispanic persons
Nonwhite = all persons not considered White, such as all Black races, Asians, Native Americans, and Pacific Islanders.

Infant Mortality

Aggregated infant mortality data from the 85 poorest rural counties in the U.S. and for the rest of the nation are presented in Tables 7-1 and 7-2 for the years 1980 through 1983.** These data are also presented in Fig. 7-1 and 7-2 (All races only). Following is a summary of the major findings from these infant mortality data:

Total Races

o The gap between the aggregate infant mortality rate in the rural poor counties and the rest of the nation increased by 32 percent between 1981 and 1983 (3.92 vs 5.16). (See Figure 2).

o By 1983, rural poor counties experienced a 46.4% higher infant mortality rate than the rest of the nation. This disparity was statistically significant ($p<.001$).

o The already higher rural poor county IMR increased between 1981 and 1982 and then decreased slightly but was still higher in 1983 than in 1981.

o The considerably higher 1976-1980 rural poor county IMR of 20.94 indicates that rates were dropping considerably during the late 70's, reaching a low in 1980 of 17.75. This rate continued its decline until 1981. However, between 1981 and 1983, not only did progress slow, but it reversed. This indicates that the increases since 1981 are not part of a long-term trend, but rather the reversal of a downward trend.

Whites

o The gap between the white IMR in rural poor counties and in the rest of the nation nearly tripled between 1981 and 1982 (.41 vs 1.19). Although the rural poor county IMR fell in 1983, the difference between the rural poor county rate and the rate in the rest of the nation was nearly twice as high as it was in 1981.

Non-Whites and Blacks

o The consistently increasing IMR experienced by nonwhites and black rural poor county residents since 1981 is responsible for the overall increase in the rural poor county IMR.

o While the white IMR decreased in 1983, the nonwhite rate continued to increase. (Black IMR data for rural poor counties for 1983 were not available at the time of this study.) This persistent increase occurred in the face of declining national IMRs among blacks and nonwhites.

o The black IMR in the rural poor counties rose to over 23 infant deaths per 1000 live births in 1982. This figure is 17.6 percent higher than that of the black IMR in the rest of the nation.

o By 1983, the IMR for nonwhites living in rural poor counties rose to nearly 21 deaths per 1000 lives births compared to a rate of 17.18 among non-whites in the rest of the country, increasing the disparity between the 2 groups from less than 12% to over 25%.

Low Birthweight

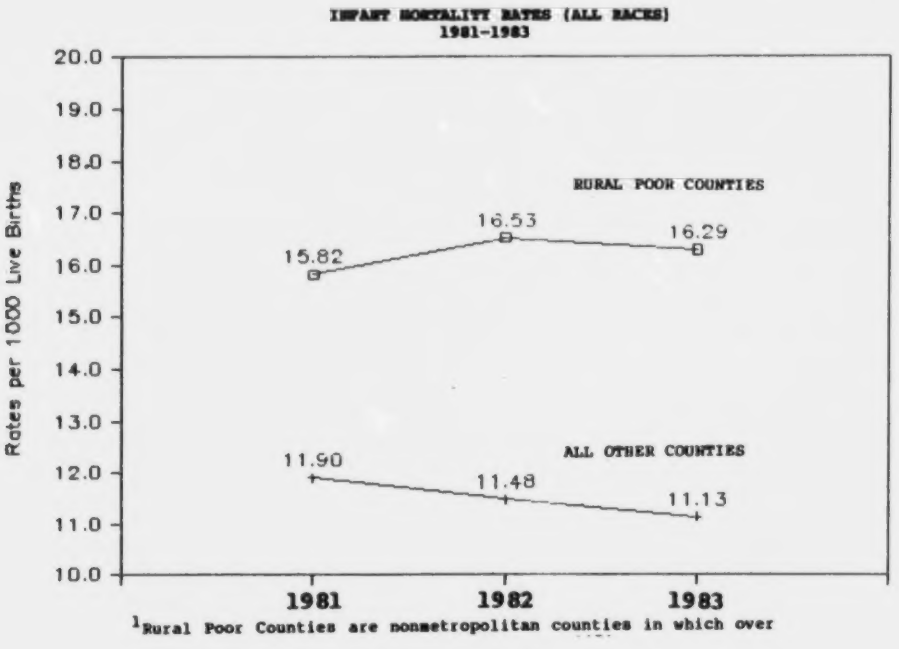
Tables 7-1 to 7-3 present a summary of the aggregated low birthweight (LBW) data from the 85 rural poor counties in the U.S. and for the rest of the nation by race for the years 1980 through 1983.* (Figure 7-3 and 7-4). The findings of greatest concern include the following:

Total Races

o The gap between the LBW rate in the rural poor counties and the LBW rate in

** 1976-1980 summary rates are also presented for comparison.

Fig. 7-1



[1]Rural Poor Counties are nonmetropolitan counties in which over

Fig. 7-2

DISPARITY BETWEEN INFANT MORTALITY RATES IN RURAL POOR COUNTIES AND IN ALL OTHER COUNTIES, 1981-1983 (Expressed as a percentage)

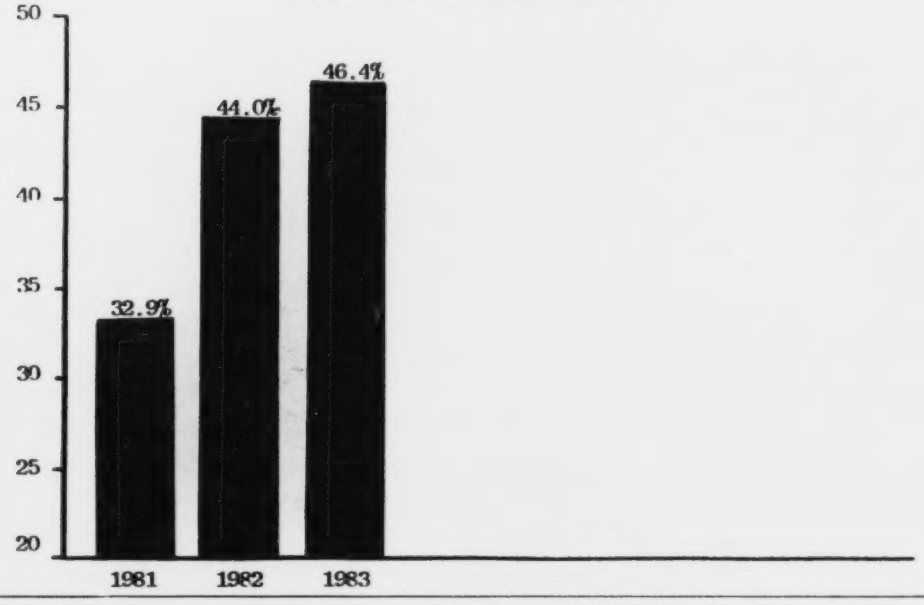


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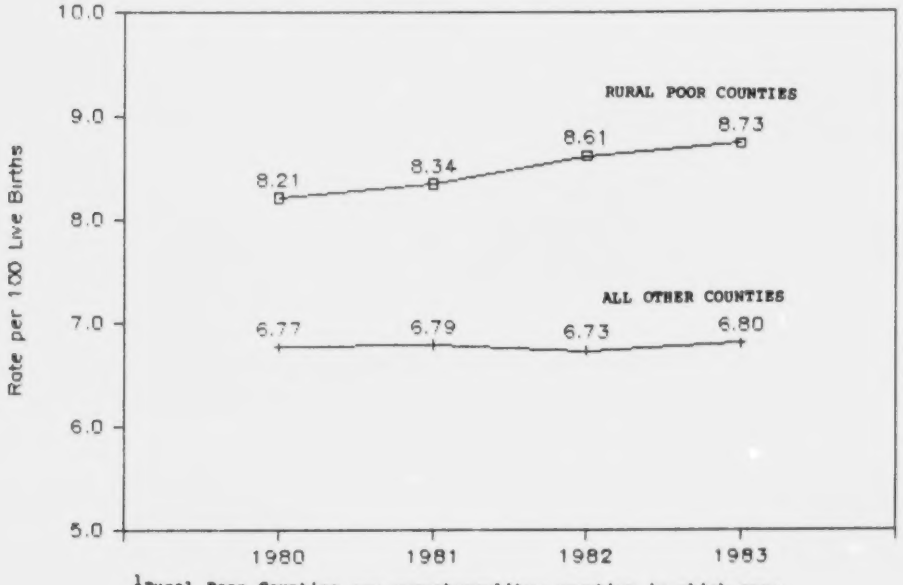
Fig. 7-3

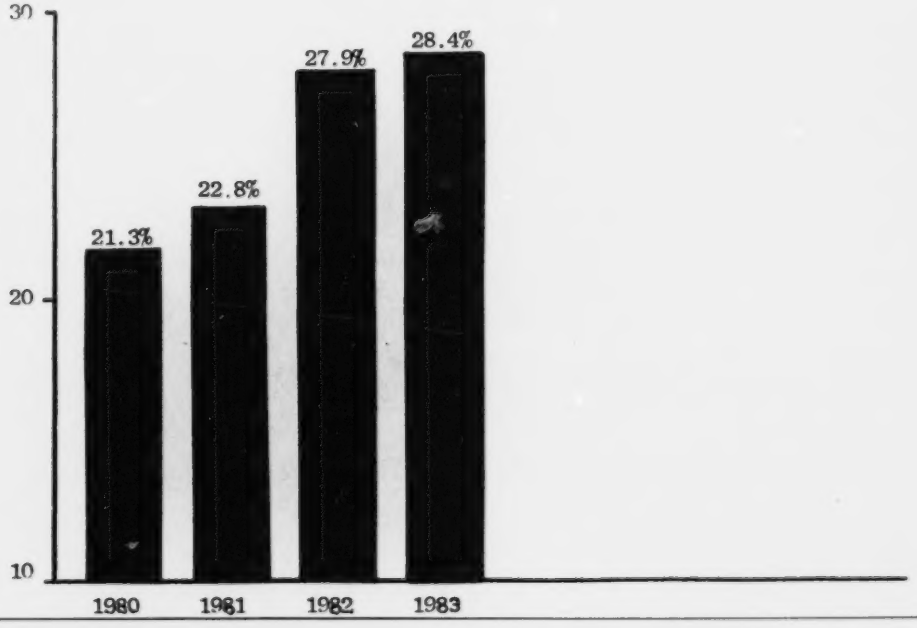
LOW BIRTHWEIGHT RATES (ALL RACES)
1980-1983



[1]Rural Poor Counties are nonmetropolitan counties in which over one-third of residents lived in poverty in 1979.

Fig. 7-4

DISPARITY BETWEEN LOW BIRTHWEIGHT RATES IN RURAL COUNTIES AND IN ALL OTHER COUNTIES, 1980-1983
(Expressed as a percentage)



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the rest of the nation grew 34 percent between 1980 and 1983 (from 1.44 per hundred live births, to 1.93 per hundred live births).

o In 1980, an additional 14 infants per 1000 live births were born low in birthweight in the rural poor counties when compared to the rest of the nation. This gap grew in 1982 to greater than 19 additional infants per 1000 live births born low birthweight in the rural poor counties. This increase represents a 34% increase in the disparity between the rural poor counties and the rest of the nation. This annual trend toward increasing differences in the incidence of low birthweight between rural poor counties and the nation at large has been consistent throughout the period studied (1980-1983).

o The increase in LBW rates which occurred in rural poor counties throughout the nation between 1980 and 1983 is statistically significant ($p<.05$).*

o The considerably higher rural poor county low birthweight rate which averaged 8.60 during the 1976-1980 period, and decreased to 8.21 by 1980, indicates that the late 1970's were also years of declining low birthweight rates in rural poor counties. However, a reversal in these trends occurred between 1980 and 1981. By 1982, the incidence of low birthweight had already risen beyond 1976-1980 levels. The increase persisted into 1983. The 1976-1980 data also indicate that the observed worsening trends represent a recent reversal of a longer-term pattern of improvement in low birthweight rates in rural poor counties.

Whites

o Low birthweight rates among whites living in rural poor counties also increased between 1980 and 1983. The increase is statistically significant ($p<.05$).

o Whereas in 1980 no gap existed in low birthweight rates between whites in rural poor counties and the rest of the nation's whites, by 1983 there were 7 additional low birthweight babies per 1000 live births in America's rural poor counties. This disparity grew consistently from 1981 to 1983. (The most recent year for which data is available.)

Nonwhites and Blacks

o The nonwhite LBW rate in rural poor counties also rose between 1980 and 1983, while that for blacks rose between 1980 and 1982 (1983 black data were unavailable).

o Although the nonwhite and black LBW rates in the rest of the nation were higher than those in the rural poor counties in 1980, they have become more similar because of the increasing rate among rural poor counties since that time.

o Nonwhite rural poor county LBW rates increased from 10.28 in 1980 to 10.63 in 1983. (They were at their lowest level of 10.10 in 1981.) During the same period, LBW rates for nonwhites in the rest of the nation fell from 11.44 to 11.35.

Summary Findings

- o Infant mortality and low birthweight rates were found to be considerably higher in rural poor counties than in the rest of the nation.
- o While the national infant mortality rate continued its downward trend into the 1981 to 1983 period (provisional data indicate that it did begin to show signs of leveling off in 1984),

* The gap in 1980 was compared to that in 1983.

the rate actually increased in rural poor counties during the same period.

- Analysis of low birthweight data reveals a similar disparity and an even greater divergence in trends, with rural poor county rates increasing, while national rates continue to decrease.
- The gap between infant mortality rates and low birthweight rates in rural poor counties and in the rest of the nation has widened since 1980 for LBW and since 1981 for IMR.
- Increases in IMRs among rural poor county non whites account for the major increases observed in the "total race" IMR for rural poor counties. On the other hand, rural poor county white rates, while higher than those of the rest of the nation, have not worsened at as high a rate.

TABLE 7-1

INFANT MORTALITY AND LOW BIRTHWEIGHT DATA FOR RURAL POOR COUNTIES

	Live Births	Low Birthweight (<2500 grams) Number	Rate	Infant Mortality (less than 1 year) Number	Rate
1976-1980					
TOTAL	130,327	11,211	8.60	2,729	20.94
1980					
TOTAL	27,102	2,224	8.21	481	17.75
WHITE	12,235	696	5.69	155	12.67
ALL OTHER	14,867	1,528	10.28	326	21.93
BLACK	11,073	1,256	11.34	267	24.11
1981					
TOTAL	25,848	2,157	8.34	409	15.82
WHITE	11,569	706	6.10	126	10.89
ALL OTHER	14,279	1,451	10.16	283	19.82
BLACK	10,522	1,174	11.16	233	22.14
1982					
TOTAL	25,956	2,234	8.61	429	16.53
WHITE	11,717	729	6.22	132	11.27
ALL OTHER	14,239	1,508	10.59	297	20.86
BLACK	10,205	1,235	12.10	235	23.03
1983					
TOTAL	24,856	2,169	8.73	405	16.29
WHITE	11,045	701	6.35	116	10.50
ALL OTHER	13,808	1,468	10.63	289	20.93
BLACK	N/A	N/A	N/A	N/A	N/A

Sources: National Center for Health Statistics, State Vital Statistics Offices, and the Information Sciences Research Institute.

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TABLE 7-2

INFANT MORTALITY AND LOW BIRTHWEIGHT DATA FOR THE U.S.
EXCEPT RURAL POOR COUNTIES

	Live Births	Low Birthweight (<2500 grams) Number	Rate	Infant Mortality (less than 1 year) Number	Rate
1976-1980					
TOTAL	16,804,028	N/A	N/A	229,647	13.67
1980					
TOTAL	3,585,156	244,068	6.77	44,775	12.49
WHITE	2,886,497	164,120	5.69	31,725	10.99
ALL OTHER	698,659	79,948	11.44	13,320	19.07
BLACK	578,543	72,206	12.48	12,336	21.32
1981					
TOTAL	3,603,390	244,592	6.79	42,896	11.90
WHITE	2,897,100	163,930	5.66	30,352	10.48
ALL OTHER	706,290	80,662	11.42	12,544	17.76
BLACK	577,275	72,298	12.52	11,524	19.96
1982					
TOTAL	3,654,581	245,870	6.73	41,972	11.48
WHITE	2,930,337	164,556	5.62	29,527	10.08
ALL OTHER	724,244	81,311	11.23	12,445	17.18
BLACK	582,436	72,125	12.38	11,407	19.58
1983					
TOTAL	3,614,077	245,499	6.80	40,222	11.13
WHITE	2,893,205	163,665	5.66	28,185	9.74
ALL OTHER	720,875	81,834	11.35	12,037	16.70
BLACK	N/A	N/A	N/A	N/A	N/A

Sources: National Center for Health Statistics, State Vital Statistics Offices, and the Information Sciences Research Institute.

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TABLE 7-3

INFANT MORTALITY AND LOW BIRTHWEIGHT DATA FOR THE UNITED STATES

	Live Births	Low Birthweight (<2500 grams) Number	Rate	Infant Mortality (less than 1 year) Number	Rate
1976-1980					
TOTAL	16,934,355	N/A	7.00	N/A	13.70
1980					
TOTAL	3,612,258	246,292	6.82	45,256	12.53
WHITE	2,898,732	164,816	5.69	31,880	10.00
ALL OTHER	713,526	81,476	11.42	13,646	19.12
BLACK	589,616	73,462	12.46	12,603	21.32
1981					
TOTAL	3,629,238	246,749	6.80	43,305	11.93
WHITE	2,908,669	164,636	5.66	30,478	10.48
ALL OTHER	720,569	82,113	11.40	12,827	17.80
BLACK	587,797	73,472	12.50	11,757	20.00
1982					
TOTAL	3,680,537	248,104	6.74	42,401	11.52
WHITE	2,942,054	165,285	5.62	29,659	10.08
ALL OTHER	738,483	82,819	11.21	12,742	17.25
BLACK	592,641	73,360	12.38	11,642	19.64
1983					
TOTAL	3,638,933	247,668	6.81	40,627	11.16
WHITE	2,904,250	164,366	5.66	28,301	9.74
ALL OTHER	734,683	83,302	11.34	12,326	16.78
BLACK	586,027	73,658	12.57	11,242	19.18

Sources: National Center for Health Statistics, State Vital Statistics Offices, and the Information Sciences Research Institute.

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Appendix A

Economic Characteristics of the 85 Poorest Rural Counties in the U.S.

County	% in Poverty [1]	# in Poverty [1]	PCI* [2]	Unemployed '85 [3]
Bullock,AL	35.45	3745	4979	14.6%
Greene	45.67	4988	4373	19.0%
Hale	39.52	6073	4792	15.06%
Lowndes	44.99	5946	4222	16.28%
Marengo	33.38	8295	6222	13.62%
Perry	43.78	6418	4502	12.7%
Sumpter	33.65	5508	5642	12.64%
Wilcox	45.28	6628	4567	14.94%
Wade-Hampton,AK	45.28	1760	4159	10.98%
Chicot,ARK	39.98	7065	4918	13.62%
Lee	44.27	6808	4155	17.5%
Monroe	34.75	4846	5067	15.66%
Phillips	39.76	13,699	5064	14.32%
St. Francis	33.78	10,321	5660	17.46%
Apache,AZ	40.02	20,675	4169	14.72%
Costilla,CO	36.14	1110	5129	19.78%
Clay,GA	40.70	1424	5323	6.2%
Dooly	33.95	3619	5749	8.2%
Hancock	39.26	3655	5180	6.48%
Jenkins	33.76	2921	5679	6.1%
Quitman	40.73	958	4491	9.96%

*PER CAPITA INCOME FOR 1983

County	% in Poverty	# in Poverty	PCI	Unemployed '85
Randolph, GA	33.70	3119	5064	7.9%
Screven	34.12	4715	6091	6.0%
Stewart	38.81	2267	4611	14.42%
Breathitt,KY	36.04	5962	5287	11.1%
Casey,	35.91	5309	4860	16.14%
Clay	42.38	9578	4375	12.9%
Clinton	39.43	3671	4370	12.36%
Jackson	39.18	4695	4368	14.36%
Knox	37.10	11,092	4910	7.8%
Lee	33.43	2553	5034	14.06%
Leslie	34.12	5077	4877	16.3%
McCreary	42.38	6143	3993	14.5%
Magoffin	35.0	4707	4541	13.56%
Morgan	36.73	4391	4781	17.2%
Owsley	48.32	2755	3670	17.22%
Wayne	35.07	5897	4935	11.36%
Wolfe	34.89	2317	4787	15.66%
E.Carroll,LA	41.83	4841	4669	21.08%
Madison	42.72	6717	5006	17.94%
Richland	35.00	7553	5903	14.34%
Tensas	41.17	3482	5868	11.74%
W.Feliciana	33.42	2529	5367	9.6%
Bolivar,MS	40.54	17,996	5251	13.22%
Coahoma	40.64	14,700	5315	13.98%
Holmes	46.90	10,525	4378	14.16%
Humphreys	44.68	6186	4693	11.44%

County	% in Poverty	# in Poverty	PCI	Unemployed'85
Issaquena,MS	36.56	918	4484	7.88%
Jefferson	41.11	3774	3931	19.78%
Kemper	37.20	3757	4744	20.5%
Leflore	34.88	13,713	5514	13.08%
Noxubee	39.53	5221	4608	17.0%
Panola	34.33	9608	5425	12.16%
Quitman	41.38	5212	4575	15.44%
Sharkey	43.97	3484	4975	19.62%
Sunflower	39.44	12,688	4847	8.96%
Tallahatchie	43.50	7437	4801	12.6%
Tunica	52.94	5088	3735	19.82%
Wilkinson	35.49	3520	4943	16.72%
Yazoo	36.31	9826	5792	11.4%
McKinley,N.M.	36.85	20,695	4422	11.6%
Mora	38.32	1610	4494	34.72%
Bennett.SD	33.52	1014	4812	3.0
Buffalo	42.47	750	2954	19.88%
Corson	41.49	2093	3436	8.5%
Dewey	35.45	1888	3897	9.82%
Jackson	35.63	1201	5000	7.3%
Mellete	38.89	856	3705	11.14%
Sanborn	35.12	1110	4744	5.68%
Shannon	44.68	4998	2892	9.4%
Todd	43.54	3142	3586	7.4%
Zieback	43.68	1006	2783	4.5%

County	% in Poverty	# in Poverty	PCI	Unemployed '85
Fentress,TN	33.49	4926	4396	18.9%
Hancock	43.05	2963	3798	16.9%
Dimmitt,TX	36.75	4123	4753	15.75%
Edwards	33.33	674	5739	5.4%
Kenedy	34.94	189	5825	3.4%
Kinney	35.32	805	6022	4.86%
Lasalle	40.50	2233	5202	13.0%
Maverick	39.50	12,357	3547	35.36%
Presidio	40.70	2102	4467	14.7%
Real	34.22	845	5795	6.32%
Starr	50.64	13,698	3100	41.4%
Willacy	34.83	6065	4786	12.9%
Zavala	38.61	4503	3908	27.24%

Source: House Select Committee on Hunger

1. Poverty statistics come from the Census of Population 1980, U.S Dept. of Commerce, Bureau of the Census:General Social and Economic Characteristics (PC80-1-C-2).

2. The PCI figure represents 1983 Per Capita Income levels.(This data will be published in P-26 and P-27 series of the U.S. Department of Commerce,Bureau of the Census:social and economic characteristics publication.
(PCI = the amount of income derived by taking the total money income for a given group and dividing it by the number of individuals in the group (as defined by the Congressional Research Service Education and Public Welfare Division).

3. The unemployment figures are the average unemployment rates for the months of January thru May 1985. (This information comes from the Department of Labor, Division of Labor and Statistics.)

Chapter 8

ASSISTANCE PROGRAM PARTICIPATION

Having presented our findings on the direct indicators of nutritional status, we now turn to our inquiry of assistance program utilization by the rural poor. Rationale for the inclusion of these data were discussed in the methodology section of this report. While the following analysis of the extent to which these programs serve the rural poor is far from exhaustive, data from several key programs are presented, including; Food Stamps, Aid to Families with Dependent Children, Free and Reduced Price School Lunch, General Assistance, Medicaid, and Social Security Income.*

In this section of the report, a brief description of each program will be provided, followed by data on participation and benefit levels by both rural (nonmetropolitan) poor and metropolitan poor populations. In most cases, comparisons will be made and presented graphically.

Rationale

The level of utilization of food, health, and income assistance programs by the poor is another useful method of assessing their health and nutrition status--albeit an indirect method.

The rationale for its utility in this role comes from the very way we determine poverty, (i.e., the inability of a household to afford the basic standard of living). Only if other necessary living costs are neglected or provided for by a source outside of the houshold unit can an impoverished household afford adequate amounts of food. Therefore, the percent of the poor who receive program benefits, whether in-kind or cash, and the per capita value of those benefits, provides critical information on the percent who are at significantly increased risk of experiencing nutritional deprivation due to inadequate financial resources.*

We chose to examine data from the years 1979-1983 when available, since they were the most current at the time of the study. Along with poverty data, analysis of recent trends in program participation might also be useful in helping to predict changes in nutritional status which have occurred among the rural poor in recent years.

FINDINGS

Food Stamp Program

The Food Stamp Program (FSP) is the only federal assistance program designed to provide benefits to low-income persons throughout the nation, based on a nationally consistent means test. Administered by the USDA it is the largest of the food assistance programs. It is also generally regarded to be the most important of the food and nutrition programs, providing benefits to more than 22 million low-income persons in 1983.

Participation

Data on participation rates in the

* We were unable to obtain comparative participation data for the Special Supplemental Food Program for Women, Infants and Children (WIC).

FSP by the rural poor reveal that over half (56.8%) remain unserved by this program (2). This compares to 53.9% of metropolitan poor who do not participate in the program. Moreover, in recent years the number of rural poor unserved by the FSP has grown rapidly (See Fig. 8-1). The number of rural poor who did not receive FSP benefits increased from 5,673,000 persons in 1979 to 7,510,000 in 1983. This represents an increase of approximately one-third (2).

For particular age segments among the rural poor, the situation is substantially worse. The elderly poor (65+ years) exemplify this situation. In 1983, only 31% of rural poor elderly households received program benefits--a level significantly lower than experienced by most other age segments (2).

Program Benefits

In addition to low utilization rates, the mean annual face value of Food Stamp benefits received by the rural poor is less than that received by the metropolitan poor. Moreover, between 1979 and 1983, the difference in mean value between Food Stamps received by low-income rural households and those received by low-income metropolitan households increased from $39 to $56** (2). Decreased benefit levels combined with lower participation rates by rural residents have resulted in vast inequities in the distribution of Food Stamp program benefits. According to the Bureau of Economic Analysis, while low-income metropolitan residents received over $8 billion in Food Stamp program benefits in 1983, only $3 billion went to low-income rural residents. This translates to a per capita level of $368 for the metropolitan poor, and $222 for the rural poor - a 71% differential* (2). (See Table 8-1 and Fig. 8-2).

Female-Headed Households

Program participation data for female-headed households (FHH) among the rural poor revealed similar trends as were observed for the rural poor in general. However, in addition to FSP data, information was also available on participation by FHHs in the Medicaid Program** and in the Free and Reduced Price School Lunch Program (for their school aged children). These data show that members in only 59.8% of poor rural FHHs were covered by the Medicaid Program in 1983. Moreover, the number of poor rural FHHs not covered by the program grew from 280,000 in 1979 to 412,000 in 1983 - an increase of over 47% (See Fig.8-3) (2). Under-participation in the Free and Reduced Price School Lunch Program by rural poor children (ages 5-18 years) living in female-headed households underwent similar increases during the period of study. In 1979, children in 344,000 poor rural female-headed households did not participate in this program. By 1983, that number had increased by over 43% to 493,000 such households (2) (See Fig. 8-3).

The number of poor, rural FHHs not participating in the Food Stamp Program also increased between 1979 and 1983. In 1979 there were 263,000 such households. That number decreased to 250,000 in 1980.

** Per capita program expenditure figures used throughout this section were determined by dividing program expenditure data (from the Department of Commerce) by the number of poor in each category of urbanization (metropolitan-nonmetropolitan). However, a certain amount of funding for these programs was also received by nonpoor residents. Therefore, these figures overstate actual per capita levels received by the poor.

TABLE 8-1

TRANSFER PAYMENTS DISTRIBUTED TO
METROPOLITAN AND NONMETROPOLITAN RESIDENTS - 1983

	METROPOLITAN		NONMETROPOLITAN	
	Total Disbursed (in thousands)	Amount Per Poor Resident[1]	Total Disbursed (in thousands)	Amount Per Poor Resident[1]
Food Stamp Program	$8,038,068	$369.57	$3,065,932	$226.84
Aid to Families With Dependent Children (AFDC)	$12,049,997	$554.02	$2,188,003	$161.88
General Assistance (GA)	$1,876,568	$86.28	$173,432	$12.83
Social Security Income (SSI)	$6,906,330	$317.53	$2,498,670	$148.87
Total Income Maintenance Payments[2]	$3,059,014	$1406.44	$8,579,986	$634.80

Source: Regional Economic Information Systems Bureau of Economic Analysis
1. Determined by dividing the total amount of payments distributed to residents living in each urbanization (metropolitan and nonmetropolitan) by the number of poor residents in each.
2. Includes: Food Stamps, AFDC, GA, SSI, Emergency Assistance, Refugee Assistance, Foster Home Care Payments, Earned Income Tax Credits, and Energy Assistance.

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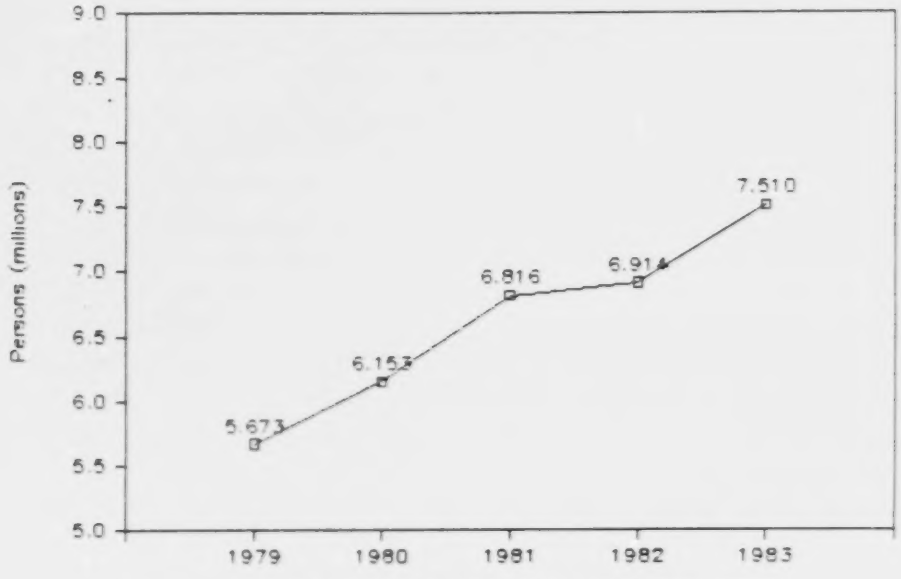
FIG. 8-1

RURAL POOR WHO DID NOT RECEIVE FOOD STAMPS
(1979-1983)



Source: Current Population Reports, Series P-60, Money Income and Poverty Status of Families and Persons in the United States, respective years.

Current Population Reports, Series P-60, Money Income and Poverty Status of Families and Persons in the United States, respective years.

[1]Nonmetropolitan poverty rates used

However, by 1983 the number had increased by 97,000 to 347,000--representing a growth of 31.9% from the 1979 level, and 38.8% from the 1980 level (2).

Aid To Families With Dependent Children (AFDC)

AFDC is another vital component of the safety net for the poor. In fact, it is the costliest of the assistance programs, disbursing more than $14 billion in payments to over 10.9 million persons in 1984 (2,25).

Unlike the FSP, AFDC targets its benefits to households with dependent children under 18 years old. Also, in contrast to the federal nature of the FSP, states determine both eligibility criteria and benefit levels of AFDC.

A "standard of need" is determined independently by each state. For eligibility, a family must have a gross income of no more than 1.5 times that level, after certain deductions are made.

Participation

Participation in the AFDC program by the rural poor was considerably lower than participation by the metropolitan poor. While 44.75% of the metropolitan poor received AFDC benefits in 1980 (the most recent year for which metropolitan/nonmetropolitan data was found) only 19.3% of the

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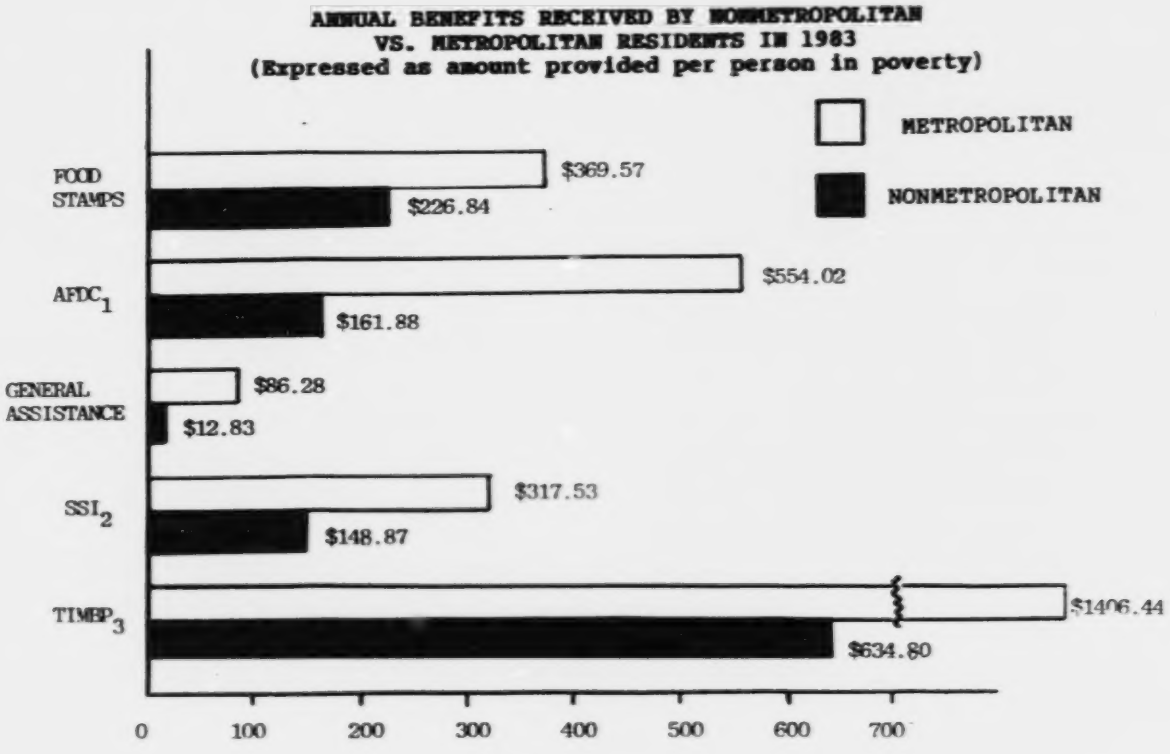
Fig. 8-2



Source: Regional Economic Information System, Bureau of Economic Analysis, Dept. of Commerce

1 Aid to Families with Dependent Children
2 Social Security Income
3 Total Income Maintenance Benefit Payments
Includes Food Stamps, AFDC, General Assistance, SSI, Emergency Assistance Refugee Assistance, Foster Home Care Payments, Earned Income Tax Credits and Energy Assistance

rural poor received AFDC benefits in that year. However, these numbers tend to exaggerate the difference somewhat, due to a number of differences between the two populations associated with the program's categorical eligibility criteria. The larger percent of female-headed households among the metropolitan poor, and the tendency for the rural poor to be older and therefore less likely to have dependents under 18 years of age are examples. In addition, a large proportion of rural poor persons reside in Southern states, where AFDC benefit levels are the lowest in the nation. While these factors explain some of the disproportionately lower rate of AFDC participation by the rural poor, a large portion of the greater than two-to-one

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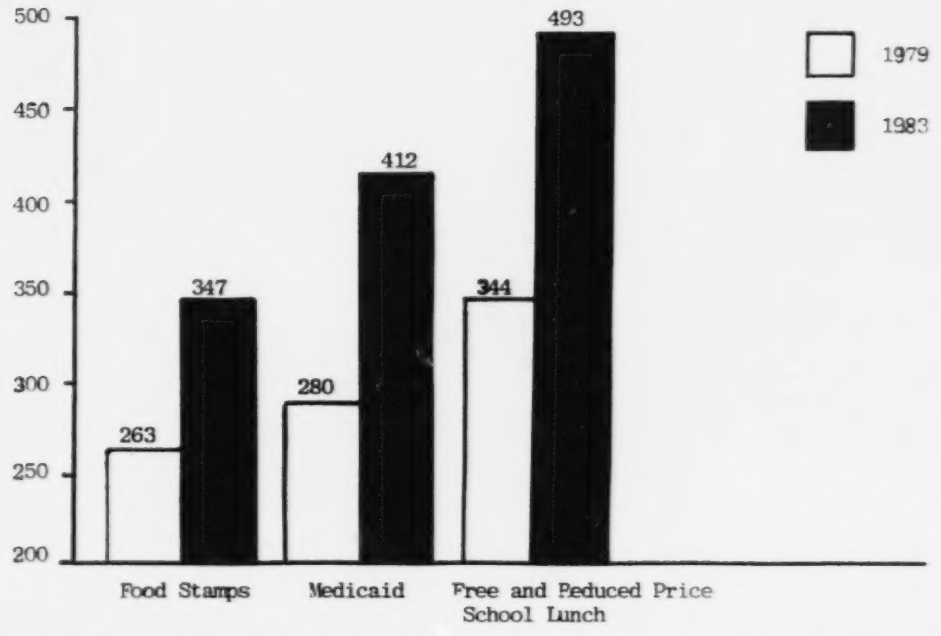
Fig. 8-3

NUMBER OF POOR RURAL FEMALE-HEADED HOUSEHOLDS THAT DID NOT RECEIVE ASSISTANCE PROGRAM BENEFITS IN 1979 AND 1983[1]

(in thousands)



Source: Current Population Reports, P-60, Characteristics of Households and Persons Receiving Noncash Benefits, respective years.

[1]Nonmetropolitan data used

disparity remains unexplained.*

Program Benefits

Similar to the distribution of Food Stamp Program benefits, the rural poor received a disproportionately small share of AFDC income transfer payments. While low-income rural residents received $162 per capita in 1983, the metropolitan poor received $552 per capita during the same year--well over three times as much (25)**. (See Table 8-1)

As indicated above, geographic factors account for much of the observed disparity. Rural poverty is most concentrated in the South. This is also the region of the nation in which states provide the lowest AFDC benefit levels, and in which state-determined "standards of need" are often the lowest in the country (21). In fact, in two-thirds of the states in the country

* A more precise method to assess the true disparity in utilization among eligible persons requires knowledge of the number of persons in each state who live in households which meet eligibility criteria for that state. Unfortunately, this information was not available at the time of the study.

** A brief description of the Medicaid Program is included in Appendix A.

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(mostly those in the South) the standards of need are below the poverty level.

Free and Reduced Price School Lunch Program Participation

The number of poor rural children (5-18 years of age) who were unserved by this program increased by 53.3 percent, from 840,000 to 1,248,000, between 1979 and 1983 (2). However, unlike other programs examined in this study, it is the metropolitan poor children who have borne the brunt of cuts and lagging growth in the Free and Reduced Price School Lunch Program. (The number of these children who did not benefit from this program increased from 2,131,000 in 1979, to 4,880,000 in 1983 (2). (Table 8-2)

General Assistance (GA)

General Assistance is the name given to a number of programs administered entirely at the state and local levels. They are financed with either state funds or a combination of state and local funds. GA programs are generally designed to provide benefits to those poor who are excluded from other programs due to categorical ineligibility. They are also designed to provide emergency aid to those in immediate need. Not all states have a GA program.

Program Participation and Benefits

As can be seen in Table 8-1, the rural poor receive an extremely small share of GA benefits compared to the metropolitan poor. In 1983, metropolitan residents received $1.877 billion, amounting to $85.28 per impoverished metropolitan resident. In contrast, rural residents received $173.4 million from the program, or $12.83 per poor rural resident - less than one-sixth as much as the metropolitan poor (25) (See Fig 8-2) .

In her conclusions regarding General Assistance benefits to the rural poor, Jesberg wrote "States that do not offer a General Assistance program are predominately rural, and of those that offer only partial coverage within the state, it appears that many more urban than rural poor residents are served. Benefits in states with statewide coverage strongly favor urban areas in payment amounts" (27). The more current analysis presented above bears out this urban bias in the GA program (25).

Supplemental Security Income Program (SSI)

The SSI program is designed to provide a minimum level of cash benefits to low-income elderly, disabled, or blind persons. Although it is administered and financed federally, some states add to the federal benefit level with state funds.

Program Participation and Benefits

SSI benefits are also disproportionately distributed in favor of metropolitan residents. As can be seen in Table 8-1 and Fig. 8-2, while metropolitan residents received over $6.9 billion, or $317.53 per poor resident in 1983 from SSI payments, rural residents received less than $2.5 billion, or $148.87 per poor resident during that year--a disparity of greater than two-to-one (2). (Considering the higher proporation of elderly poor in rural areas, this disparity is likely even greater.)

Total Income Maintenance Payments

Included in this category are SSI, AFDC, GA, and Food Stamps, as well as several smaller Income Maintenance Programs.*

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* Other programs include Emergency Assistance, Refugee Assistance, Foster Home Care Payments, Earned Income Tax Credits, and Energy Assistance

Analysis of total Income Maintenance Payments provides an overall perspective on the level of government income transfer payments received by the rural poor relative to their metropolitan counterparts.

As seen in Table 8-1 and Fig. 8-2, rural residents received less than one half as much in income maintenance payments per poor resident as did poor metropolitan residents in 1983 ($634.80 vs. $1406.44) (2)*.

Summary

- Less than 43% of poor rural residents receive Food Stamp benefits.
- The number of rural poor unserved by the FSP increased by over 1.9 million persons or 33.1% between 1979 and 1983.
- The numbers of rural poor female-headed households not covered by the Food Stamp Program, the Free and Reduced Price School Lunch Program, and the Medicaid Program, increased rapidly between 1979 and 1983.
- Extremely low participation rates in the Food Stamp Program exist among rural poor elderly persons - only 31% of whom participated in 1983.
- The value of Food Stamps distributed to the rural poor is considerably less than the amount received by the metropolitan poor - and the gap is increasing.
- The rural poor experience both lower participation rates and lower benefit levels in the AFDC program than their metropolitan counterparts.
- Less than 20% of the rural poor participated in the AFDC program, compared to 44.8% of the metropolitan poor.
- Per capita, the metropolitan poor received more than three times the level of AFDC benefits as the rural poor.
- The number of rural poor children unserved by the Free and Reduced Price School Lunch Program increased 53.3 percent between 1979 and 1983. However, the number of poor metropolitan children not served by this program increased by an even greater number.
- Rural poor residents received less than half the per capita SSI payments ($148.87) as the metropolitan poor ($317.53) in 1983.
- The rural poor were almost entirely excluded from General Assistance program benefits. In 1983, they received only $12.83 per capita from these programs compared to $86.28 received by the metropolitan poor.
- All told, when Total Income Maintenance Payments are considered for 1983, the rural poor received $634.80 per capita--considerably less than one half the per capita amount received by their metropolitan counterparts.

Conclusions

Distribution of public assistance program benefits by both federal and state governments is grossly inequitable. The rural poor receive a disproportionately lower level of benefits than do other segments of the poor population. Not only are they less likely to participate, those who do take part receive lower benefit levels on the average than do the metropolitan poor.

* Not all food stamp benefits go to the poor, since the income eligibility criteria for the program is 130 percent of the poverty level. Therefore, the actual per capita levels for the poor are somewhat less than the amounts shown.

TABLE 8-2

POOR, RURAL, SCHOOL-AGE CHILDREN WHO DO NOT RECEIVE FREE OR REDUCED PRICE SCHOOL LUNCHES (FRPSL)

Year	Poor, Rural Children (5-18 years)	Poor, Rural Children Who Received FRPSL	Poor, Rural Children Who did not Receive FRPSL
1979	2,689,000	1,875,000	814,000
1980	2,942,000	1,985,000	957,000
1981	3,254,000	2,153,000	1,101,000
1982	3,524,000	2,445,000	1,079,000
1983	3,539,000	2,291,000	1,248,000

Source: Department of Commerce, Bureau of the Census, Characteristics of Households and Persons Receiving Selected Noncash Benefits, Current Population Reports, Series P-60, Respective Years.

The combined effects of low participation and low benefit levels of the Food Stamp, AFDC, and other programs act synergistically, decreasing the ability of the rural poor family to purchase adequate amounts of food. In particular, the widening gap between the number of rural poor (over 13.5 million) and the number of rural poor who receive food stamps (5.7 million) is cause for serious concern with regard to nutritional status.

In addition to recent program cuts and increasing numbers of those not reached, the rural poor also bear the brunt of serious inequities in the distribution of other programs as well, including: General Assistance, Social Security Income, the School Lunch Program, AFDC and numerous others.

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